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SLIDES: Last in Line: Environmental Impacts of Increased Colorado River Stress and Shortages

Michael Cohen

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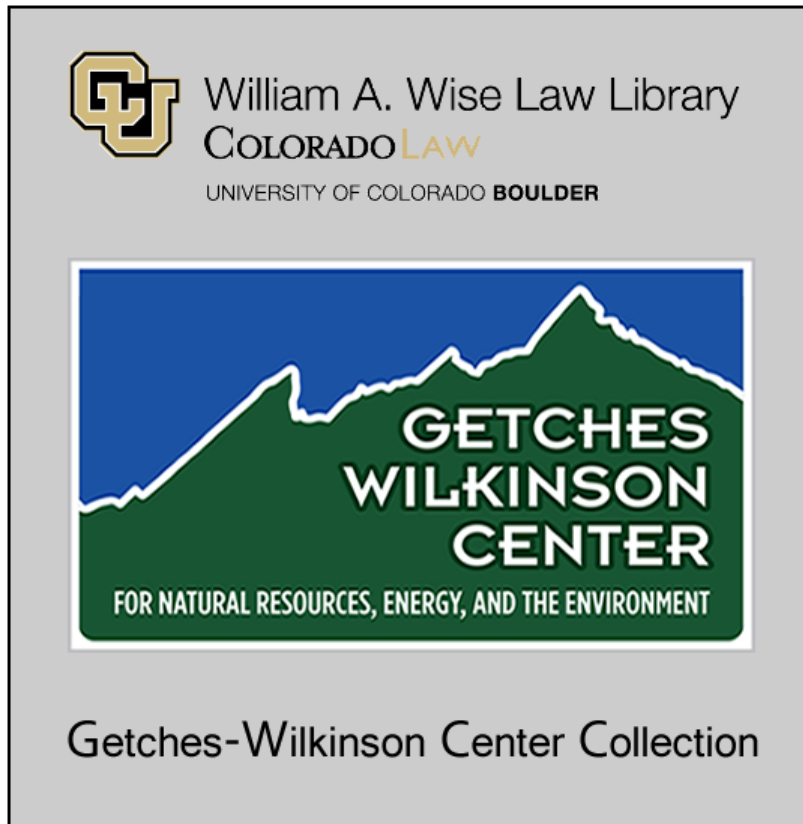
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Last in Line

Environmental Impacts of Increased Colorado River Stress and Shortages

Michael Cohen
June 8, 2005

Environmental Impacts overview

- **baseline**
- **direct basin impacts**
- **indirect impacts**
- **differences due to
institutions, not hydrology**

Baseline

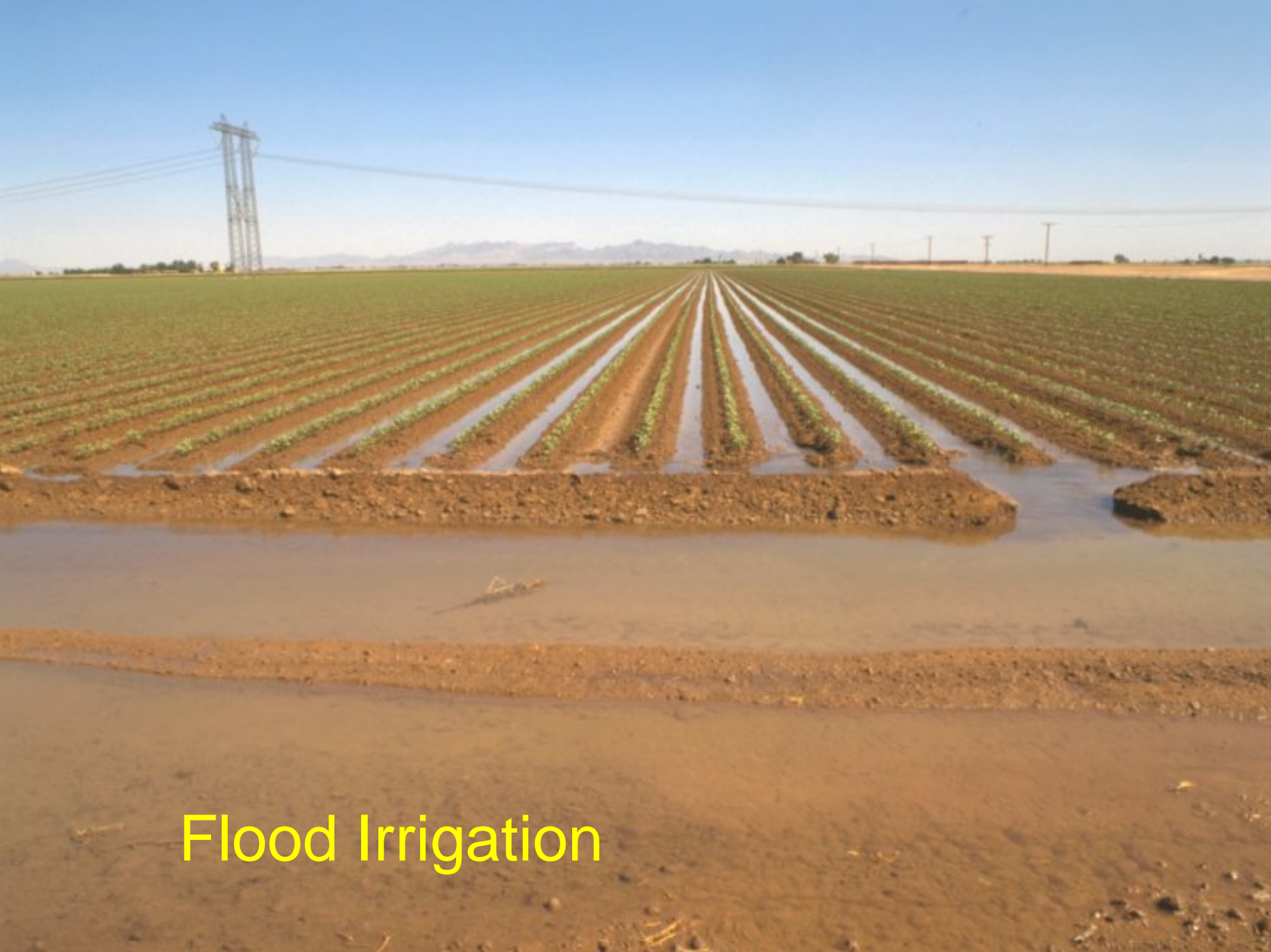
- **Limited legal recognition of env**
- **Ecosystem already imperiled by**
 - **depleted river flows**
 - **multiple dams**
 - **altered hydrograph**
 - **non-native species**

Law of the River & the Env.

- Article 1(2) of LROC: “...enhancement of fish and wildlife, and other environmental factors.”
- Grand Canyon Protection Act
- ESA – “applies to proposed discretionary actions” (70 FedReg 15879)
- Reserved Rights – 79 KAF for lower NWRs
- MSCP?

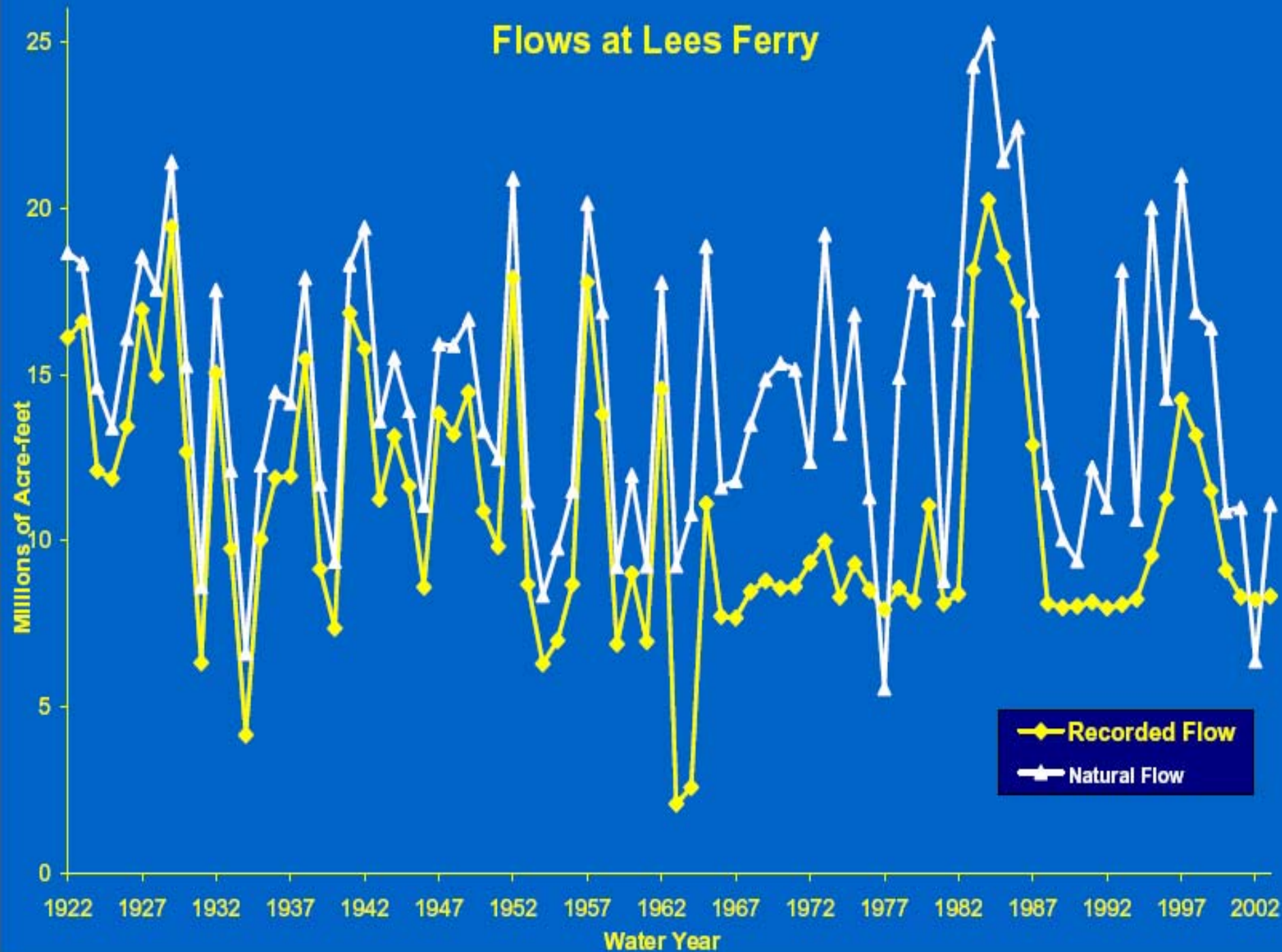
I wish to make it clear to you, there is not sufficient water to irrigate all the lands which could be irrigated, and only a small portion can be irrigated. I tell you, gentlemen, you are piling up a heritage of conflict!

-- *John Wesley Powell, speech, 1893*

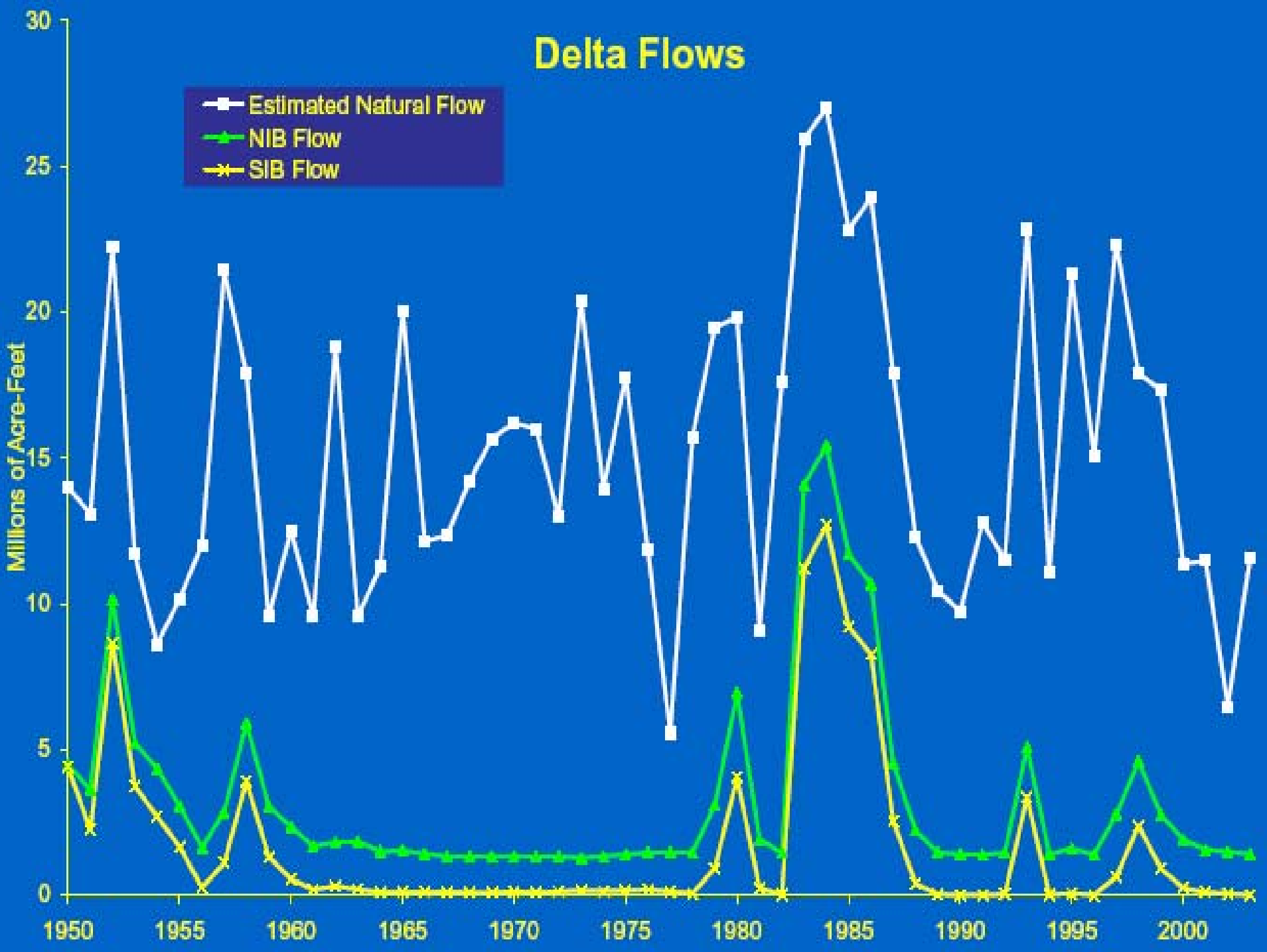


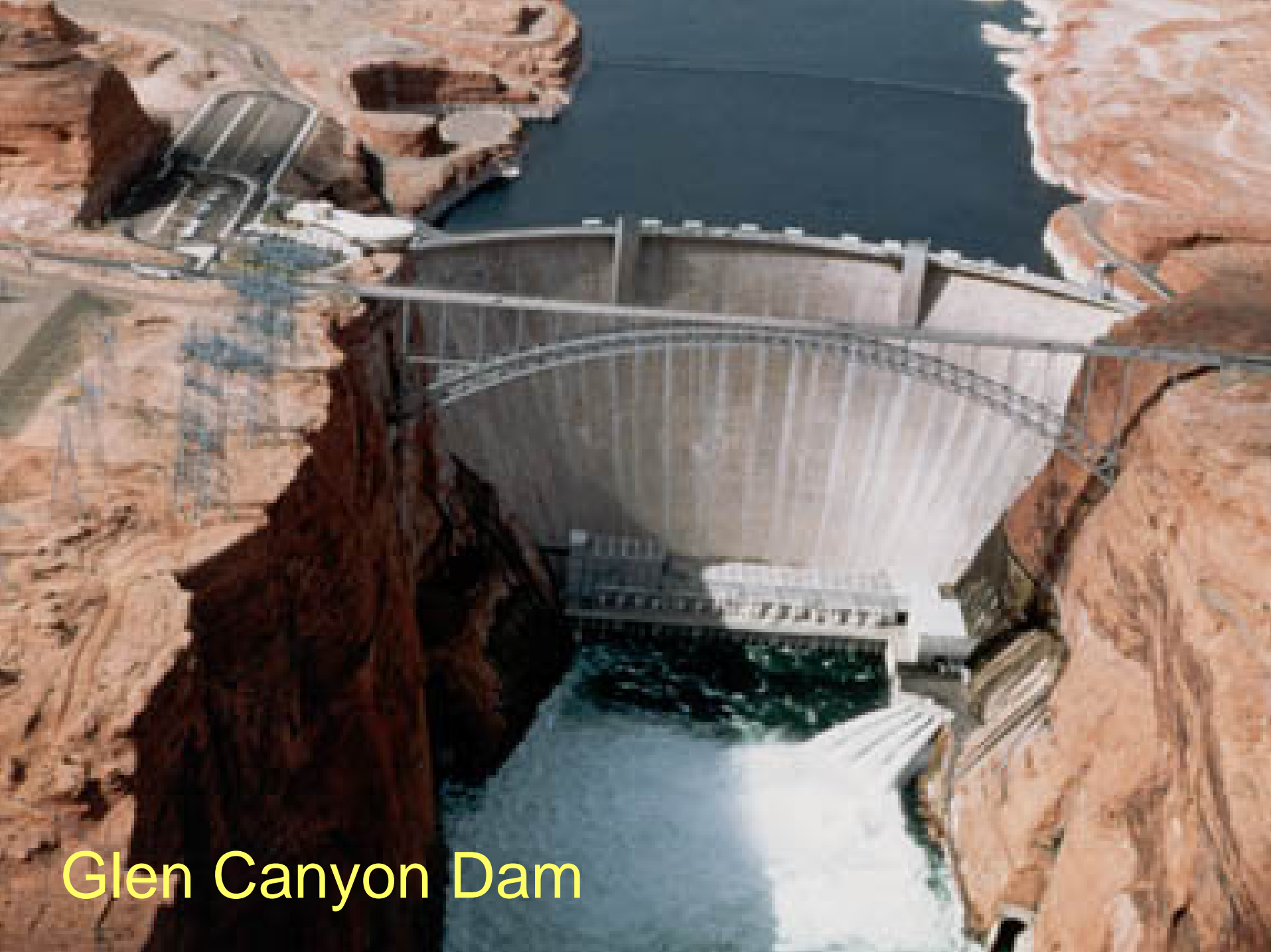
Flood Irrigation

Flows at Lees Ferry



Delta Flows





Glen Canyon Dam



Imperial Dam & Desilting Works
C423-300-020000



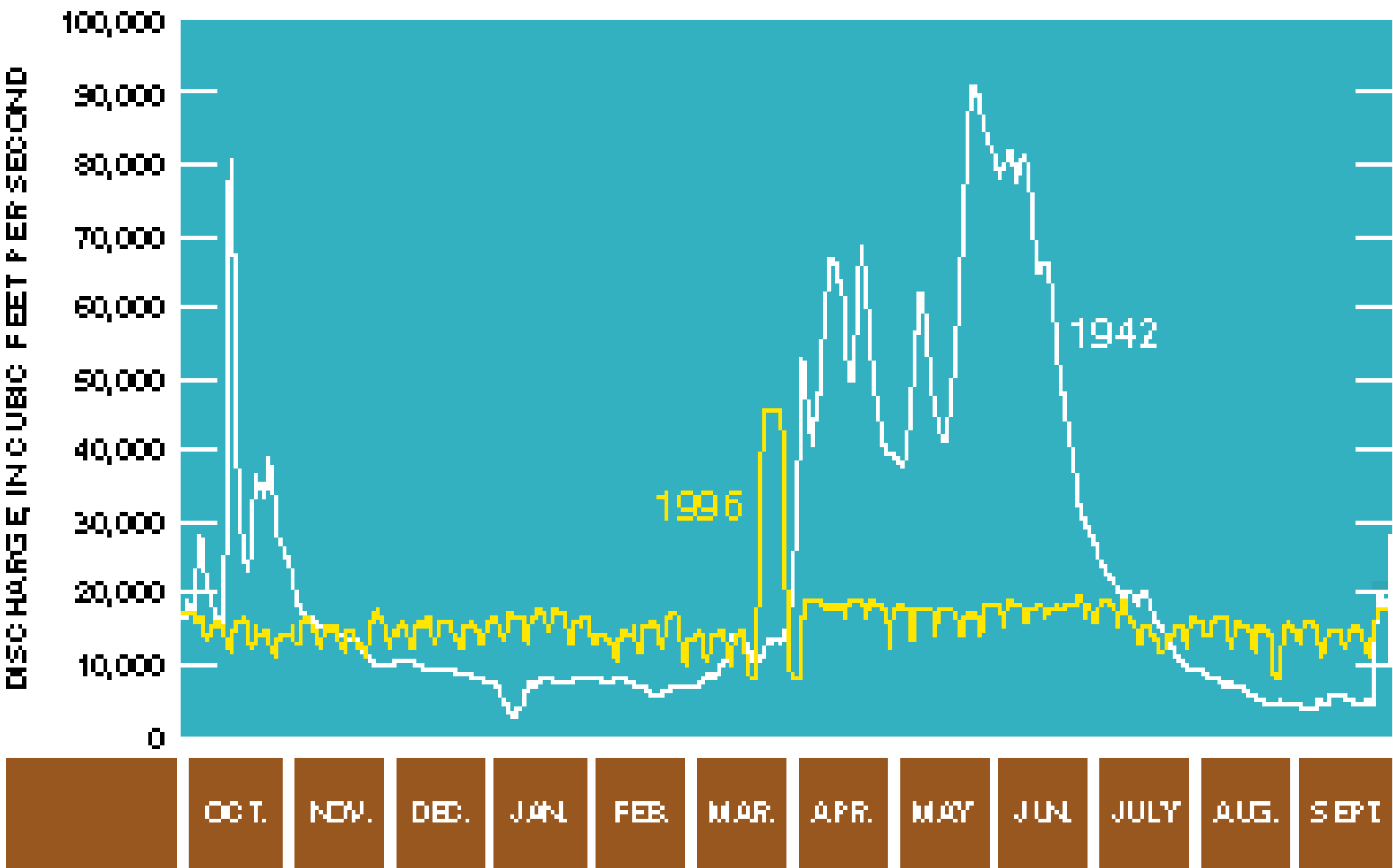
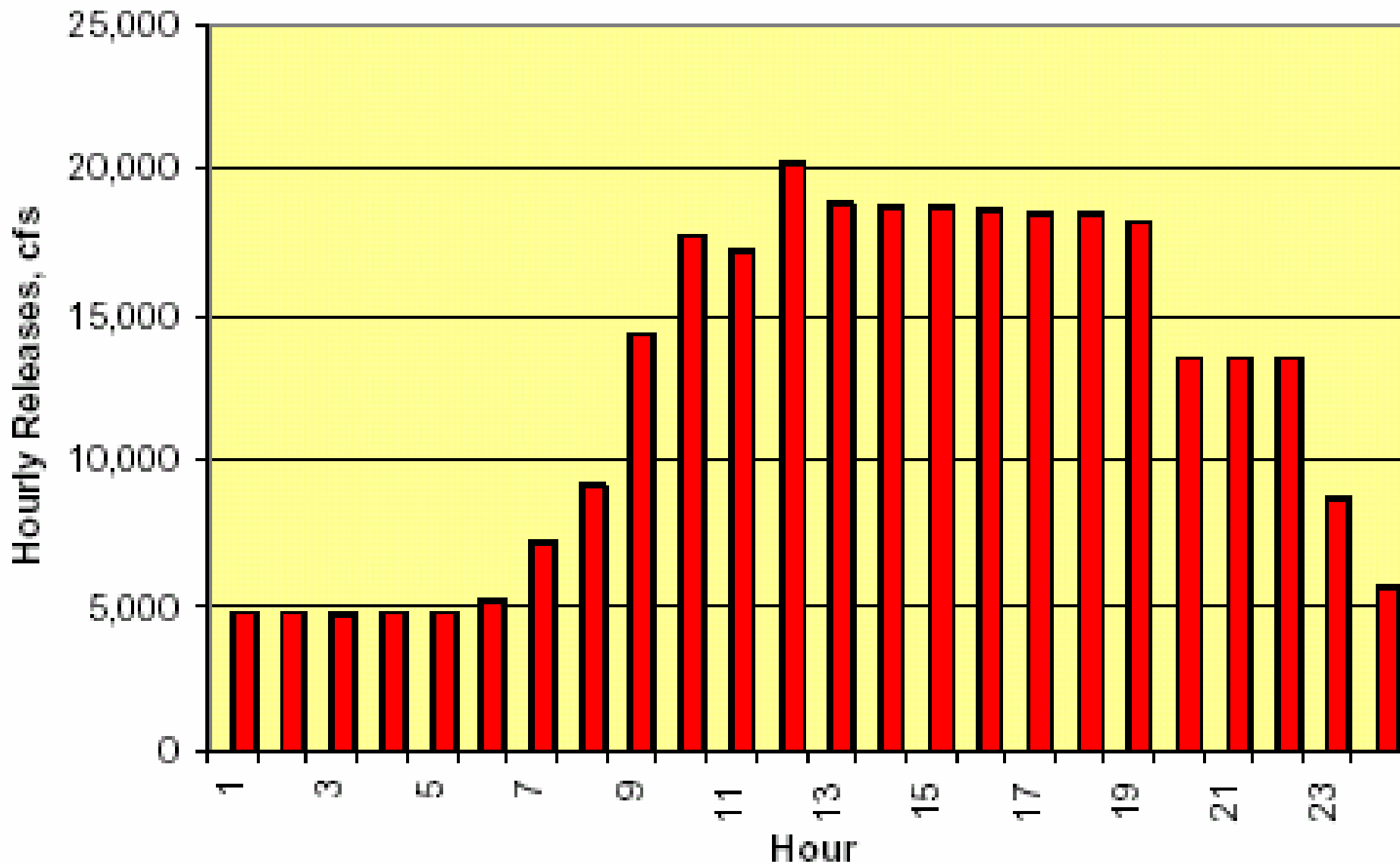


Figure 3. Daily mean discharge at Colorado River at Lees Ferry, Arizona, 1942 and 1996 water years.

SPRING AS REPRESENTED BY APR 24, 2001



Parker Dam Hourly Releases for Typical Seasonal Flow Release Patterns



Source: Western Arizona Fishing Guide Service



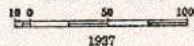




UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER BASIN

MAP NO. 26380

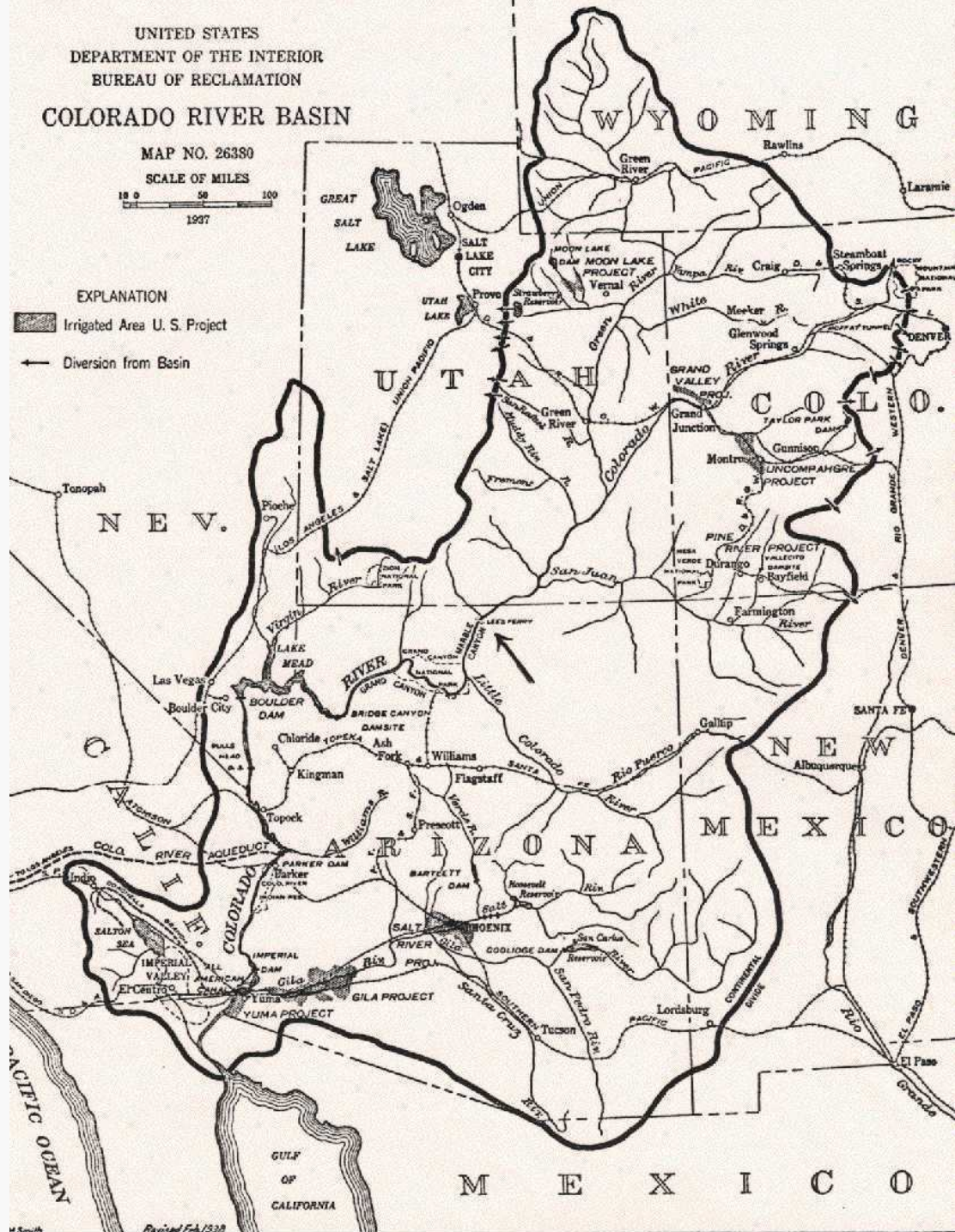
SCALE OF MILES



EXPLANATION

Irrigated Area U. S. Project

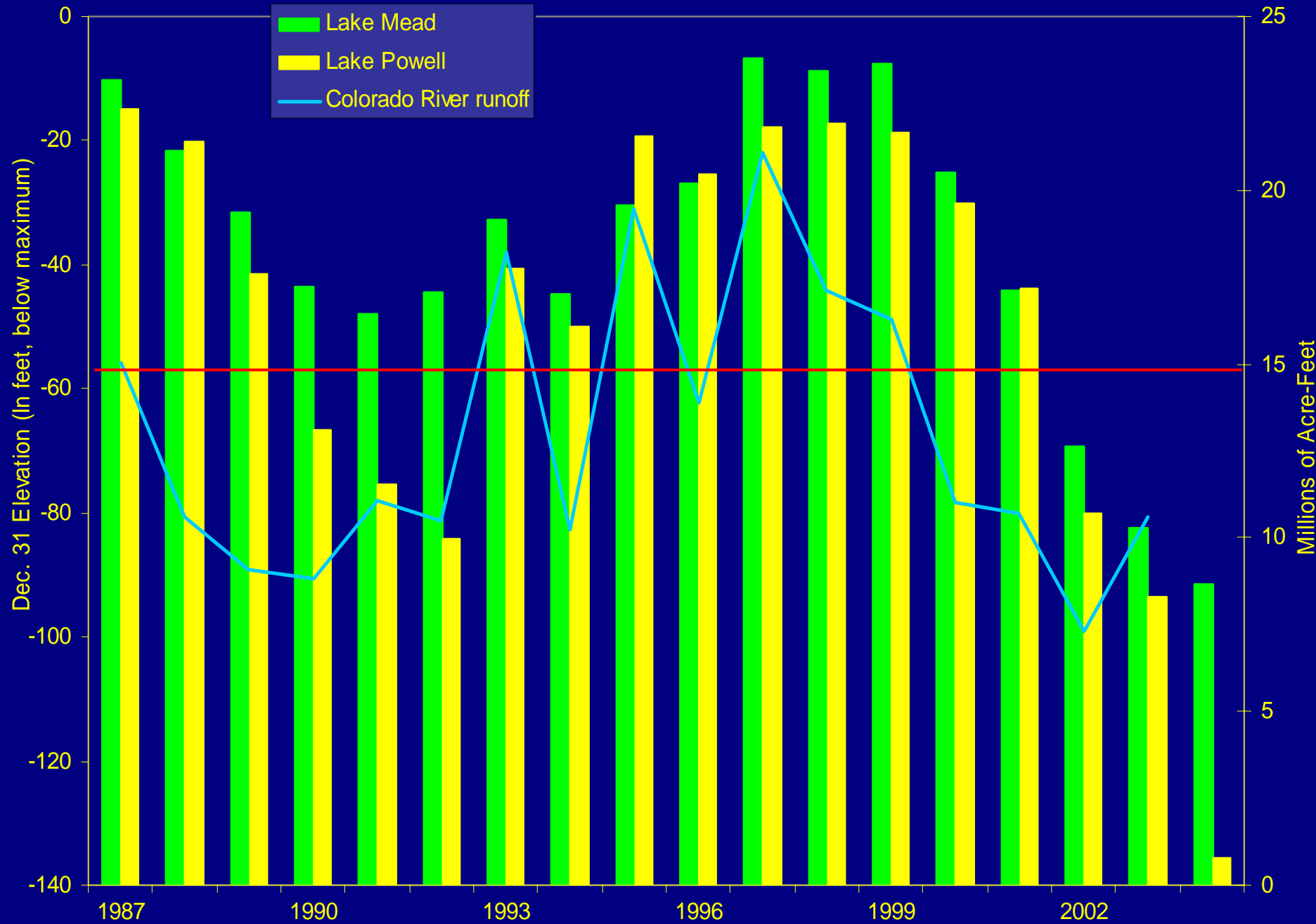
← Diversion from Basin



Upper Basin Impacts

- Depleted flows – fish kills
- reduced funding
- degradation of water quality

Colorado River Reservoir Elevations



Lower Basin Impacts

- Insulated from drought
- 2002 Cons. Use – 8.4 MAF
 - 5.37 MAF in CA
 - AZ banked 0.3488 MAF
- 43 CFR 417 review of IID – 2003
- QSA – Salton Sea impacts

- More than 400 bird species recorded at and around the Sea
- 90% of North American eared grebes
- 90% of western population of American White pelican (up to more than 30,000)



- Over 40,000 ruddy ducks (half of ruddies in Pacific Flyway)

IWMP at time of review (since revised)

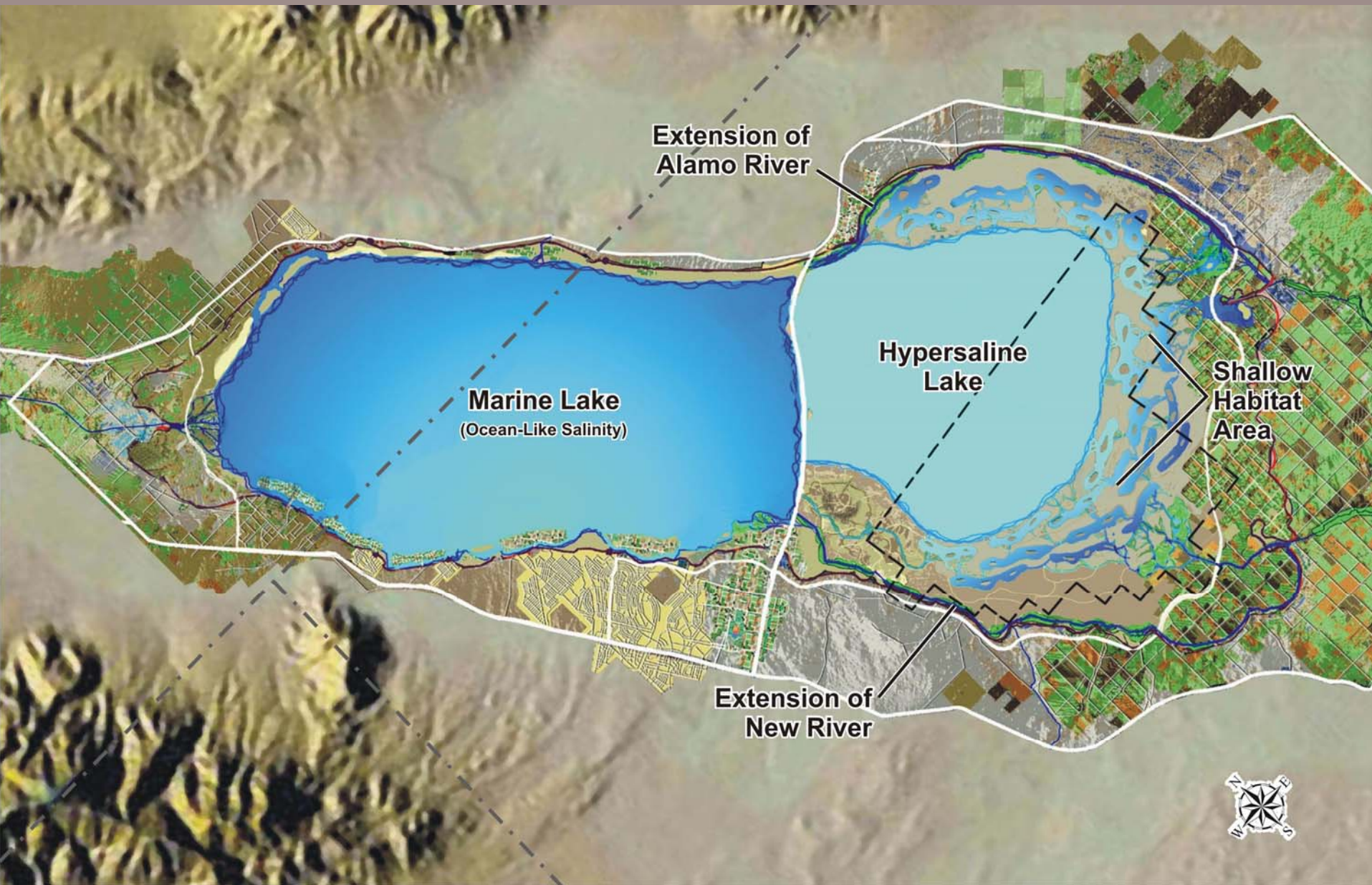




photo courtesy of Norm Niver

Delta Impacts

- Reduced flows on mainstem
- Pressure to operate YDP
- Re-allocation within Mexico
- Greater reliance on GW will lead to mining, potentially impacting riparian species



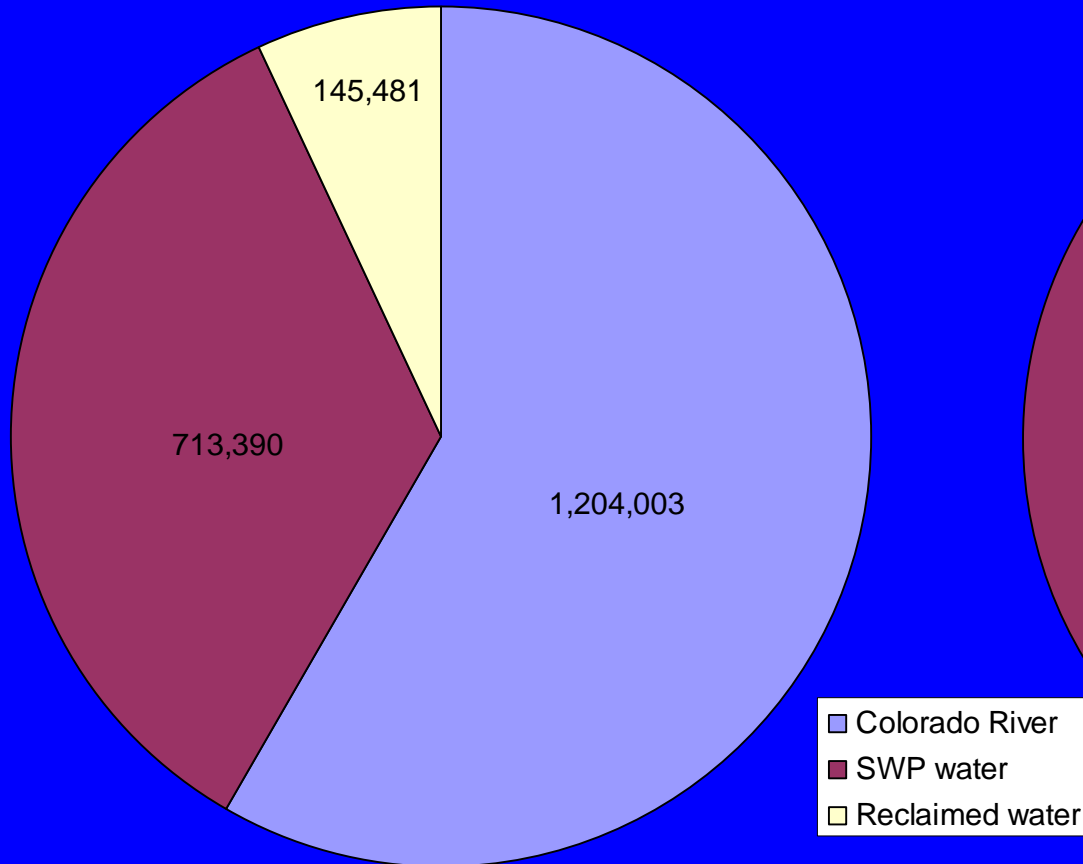


Indirect Impacts

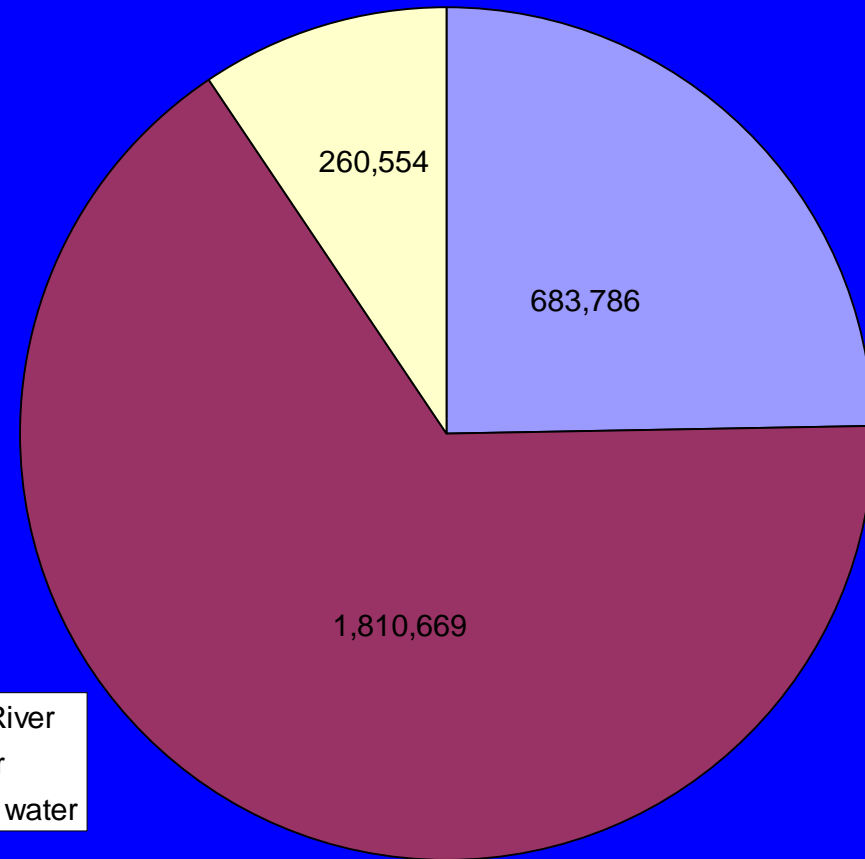
Increased pressure on other sources,
such as:

- CA Bay-Delta
- NV GW

Sources of MWD Water

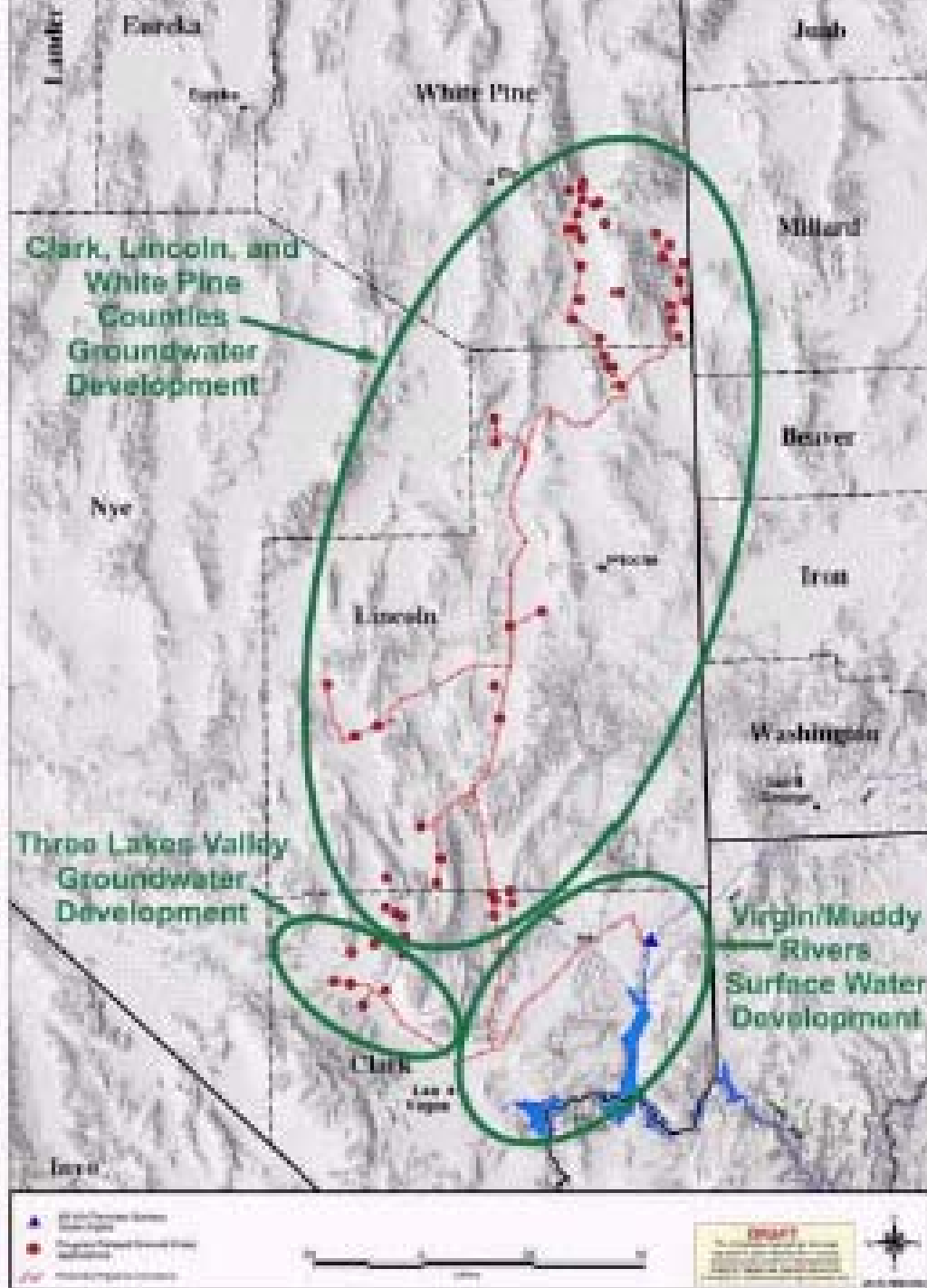


1993 – total 2,062,874 AF



2003 – total 2,755,009

Nevada water development



Source: SNWA *Concepts for Development of Additional In-State Water Resources*

Summary

- Even in high flow conditions, river's ecosystem imperiled
- Shortage and stress disproportionately impact Upper Basin and Mexico resources
- Impacts ripple out well beyond basin

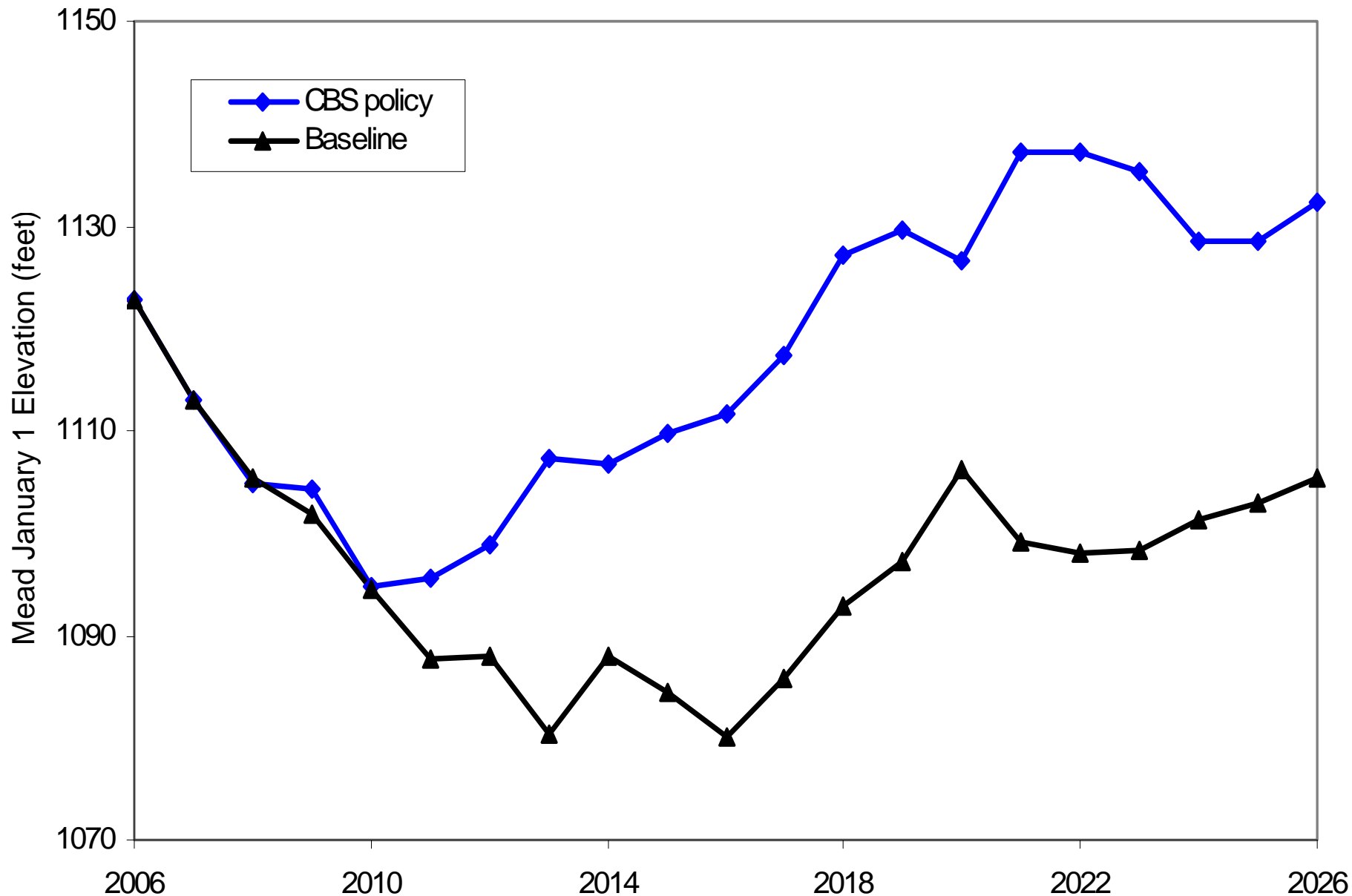
Shortage Strategies

- **Conjunctive reservoir management**
- **YDP operation**
- **New storage**
- **‘Share’ shortage with Mexico**
- **Conservation Before Shortage**

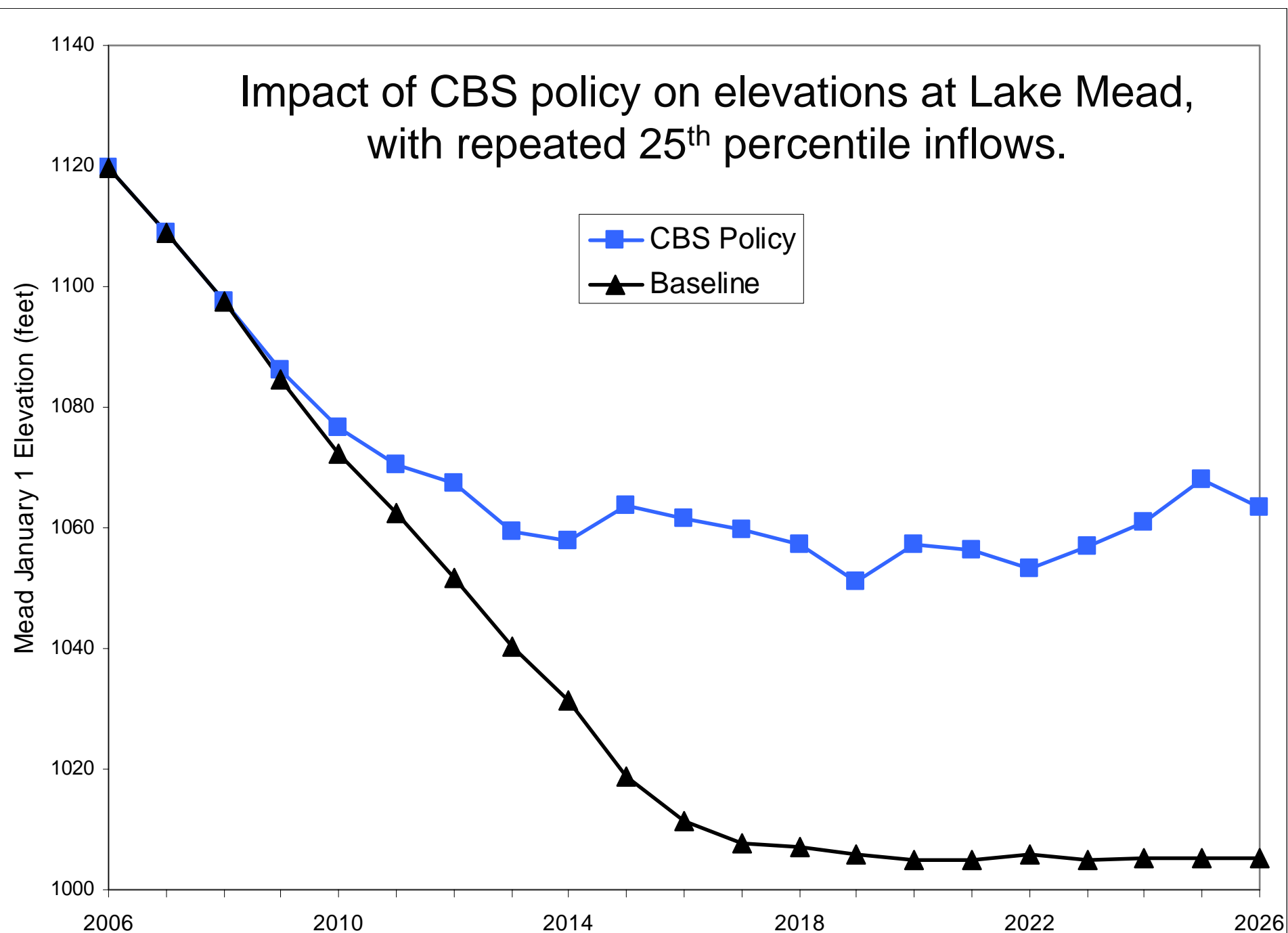
‘Conservation Before Shortage’

- Mead elevations trigger conservation
- voluntary, short-term
- paid
- reduced risk of large, uncompensated shortage

Impact of CBS policy on elevations at Lake Mead, with repeated 50th percentile inflows.



Impact of CBS policy on elevations at Lake Mead, with repeated 25th percentile inflows.



SIERRA CLUB, SOUTHWEST RIVERS, DEFENDERS OF WILDLIFE, LAND AND
WATER FUND OF THE ROCKIES, ENVIRONMENTAL DEFENSE, PACIFIC
INSTITUTE, FRIENDS OF ARIZONA RIVERS, LIVING RIVERS AND AMERICAN
RIVERS

3/25/02

Regional Director
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Lower Colorado Region
Bureau of Reclamation
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(702) 293-8042 (fax)

RE: Review of Existing Coordinate Long Range Operating Criteria for Colorado River
Reservoirs

Dear Mr. Johnson,

The following comments are submitted on behalf of the Sierra Club, Southwest Rivers, Defenders of Wildlife, Land and Water Fund of the Rockies, Environmental Defense, Pacific Institute, Friends of Arizona Rivers, Living Rivers, and American Rivers. We ask that you take them into consideration as part of your formal 5-year review of the Operating Criteria in accordance with Section 602(b) of P.L. 90-537.

We recommend that the Operating Criteria be modified. They currently do not reflect additions and changes to the Law of the River that have been made since these Operating Criteria were first established in 1970, nor do they reflect other federal laws that have been promulgated since 1970 that have bearing on the Secretary's responsibilities within the Colorado River system. We recommend a number of specific changes to the Operating Criteria, and offer several other general comments and recommendations.

Recommendations for Specific Changes to the Operating Criteria

1. As noted in the January 15, 2002 Federal Register Notice (67 CFR 1986), the Secretary's consultation responsibilities have been specifically extended to encompass the general public. We recommend that this responsibility be reflected in the Operating Criteria by adding the phrase "and the public" to the end of the second introductory paragraph.
2. The Grand Canyon Protection Act (P.L. 102-575) charged the Secretary with operating Glen Canyon Dam "in such a manner as to protect, mitigate impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established...." We recommend that the protection and enhancement of these values be inserted as reservoir uses that are considered in developing the annual operating plan under section I (2) of the

Operating Criteria by adding the phrase “protection of cultural resources,” after “water quality control,” and before “recreation”, and by adding the phrase “protection and enhancement of national park values,” after “enhancement of fish and wildlife,” and before “and other environmental factors.”

3. Although the phrase “recurrence of critical periods of water supply” that is included in section II (1)(d) may have been universally understood when these Operating Criteria were originally established, its meaning is unclear to us. We recommend that either a definition of this phrase be included in the definitions section or that the entire clause beginning with the word “including” be deleted.
4. We question whether the “Report of the Committee on Probabilities and Test Studies to the Task Force on Operating Criteria for the Colorado River,” dated October 30, 1969, which is referenced in section II (1)(e) of the Operating Criteria still has relevance in determining 602(a) storage. We request either that the Bureau of Reclamation provide us with a copy of that report or a summary of it, or that section II (1)(e) be deleted from the Operating Criteria.
5. The Secretary and her agencies are engaged in modification of river operations in various parts of the basin in order to meet their responsibilities under the Endangered Species Act (P.L. 93-205, as amended). In order to reflect these changes we recommend that a new subsection be added to section II (1) that reads: “Streamflow requirements of fish and wildlife, and other environmental values.”
6. The last sentence in section II (2) refers to operations in 1971 and 1972, and is no longer of any relevance. We recommend that this sentence be deleted.
7. In recognition of the Secretary’s responsibilities under the Grand Canyon Protection Act and the Endangered Species Act, we recommend that a new subsection (d) be added to section II (3) that reads: “to meet the requirements of the Grand Canyon Protection Act and the Endangered Species Act.”
8. Given that the Colorado River Storage Project Act lists generation of hydroelectric power as an incidental purpose for Glen Canyon Dam, and that the Record of Decision (ROD) on operations of Glen Canyon Dam interprets the mandates of the Grand Canyon Protection Act to allow bypass of water at the Glen Canyon Powerplant under limited conditions and for specified purposes, we suggest the language in section II(4) is not appropriate. We recommend that this section be deleted.
9. In recognition of the Secretary’s responsibilities under the National Environmental Policy Act, the Endangered Species Act, as well as the Law of the River, we recommend inserting the following phrase at the beginning of section III (1): “Consistent with applicable federal laws, including but not limited to the National Environmental Policy Act and the Endangered Species Act,”.

10. Section III(2) is no longer pertinent and we recommend that it be deleted.
11. To reflect the mandates of the Grand Canyon Protection Act within the universe of project purposes at Glen Canyon Dam, we recommend adding the phrase “and the protection and enhancement of national park values in Grand Canyon National Park and/or Glen Canyon National Recreation Area” at the end of section IV (1)(a).
12. To make section IV (1)(b) consistent with Article II(B)(2) of the decree in *Arizona v. California*, the word “demands” following the phrase “consumptive use” in this section should be deleted.
13. Since section IV (1)(d) defines a term used solely in section II (4), we recommend that it be deleted along with section II (4).

General Comments and Recommendations

Section III (3)(c) recognizes the Secretary’s authority to determine the existence of a shortage condition. Since specific criteria for determining shortage conditions have not yet been developed, the Bureau of Reclamation uses certain assumptions about shortage conditions in their environmental analyses of other significant federal actions related to river operations. Those assumptions have a cumulative effect on the river system and its environmental resources, yet the public has not had an opportunity to comment specifically on those shortage assumptions. To correct this situation, we ask the Secretary to initiate the process of establishing criteria for determining shortage conditions.

Although we understand that the Interim Surplus Criteria (ISC) are not subject to review at this time, we wish to continue to express our concerns that the ISC will have an adverse impact on the Colorado River delta.

Finally, as Commissioner Keys noted last December, Reclamation is considering “more NEPA” during this review, and we request that Reclamation conduct an environmental review of these Operating Criteria under NEPA. The LROC are reviewed every five years; previous reviews occurred in 1975, 1980, 1985, 1990, and 1996-98, and resulted in no changes to the LROC. 63 Fed. Reg. 9256, 9257 (Feb. 24, 1998). The decision not to change the operating criteria is subject to NEPA, and a categorical exclusion was executed during the two most recent reviews. 58 Fed. Reg. 11864, 11868 (March 1, 1993); 63 Fed. Reg. 9256, 9259 (citing 516 DM 2, App. 1.7 which provides that a CE may be prepared for “routine government business, including such things as supervision, administration, operations, maintenance and replacement activities having limited context and intensity; e.g. limited size and magnitude or short-term effects”) (emphasis added). Long-range operating criteria for the Colorado River reservoir system are, by definition, neither of limited size nor with short-term effects. A categorical exclusion is inappropriate.

Furthermore, a categorical exclusion is arbitrary and capricious because the actual promulgation of the LROC has not been evaluated in a NEPA process, although NEPA was in effect when these Operating Criteria were established. In 1980, the Department of the Interior “recognized the desirability and necessity of completing a CEIS for the entire Colorado River Basin” and decided that continuing operations in the Colorado River Basin, including the LROC, were a major federal action. *Environmental Defense Fund v. Higginson*, 655 F.2d 1244, 1246 (D.C. Cir. 1981) (emphasis added). See also *Badoni v. Higginson*, 638 F.2d 172, 181 (10th Cir. 1980). In fact, the Tenth Circuit has recognized that the Colorado River Basin Project Act’s purpose was “further comprehensive development of the water resources of the Colorado River Basin,” *Id.* (citing 43 U.S.C. § 1501(a)) and that the water projects are “interrelated and interdependent,” *Friends of the Earth v. Armstrong*, 485 F.2d 1, 6 (10th Cir. 1973). Because neither this basin-wide EIS, nor a series of site-specific EISs, has been completed, execution of a categorical exclusion rather than an EA or EIS during this review does not satisfy NEPA.

As described above, we believe that Reclamation needs to revise the Operating Criteria. We do not request a public meeting to submit these comments. Thank you for this opportunity to comment on the Operating Criteria.

Sincerely,



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**Balancing Water Needs on the Lower
Colorado River:**

**Recommendations of the Yuma Desalting
Plant/Cienega de Santa Clara Workgroup**

April 22, 2005

Executive Summary

The Yuma Desalting Plant Issues Workgroup

For more than forty years controversy and complexity have surrounded the Yuma Desalting Plant (YDP) and the circumstances that led to its construction. Changing conditions on the Lower Colorado River, including increased demand for water and recent record-setting drought conditions have resulted in an insistence by water users groups that the YDP be operated to reduce the bypass of drainage water to Mexico from the Wellton-Mohawk Irrigation and Drainage District (WMIDD). However, operation of the YDP would be expensive and could result in severe environmental impacts to the Cienega de Santa Clara (Cienega), a large wetland, sustained by drainage water the YDP was originally designed to treat. These divergent points of view on how to deal with the bypass flow have resulted in a stalemate and no action plan has been forthcoming from the federal government agencies that have responsibility for replacing the bypass flow.

The YDP/Cienega Workgroup was created at the invitation of Sid Wilson, general manager of the Central Arizona Project, to develop solutions that would both offset the impact of the continued bypass of return flows from the Wellton-Mohawk Irrigation and Drainage District and preserve the Cienega de Santa Clara. The members of the Workgroup, who are all knowledgeable about the issues associated with the YDP and the Cienega, were asked to share their expertise and ideas.

This white paper documents the findings and recommendations of the YDP/Cienega Workgroup. The Workgroup members desire to share their effort with a wider group of interested parties. They hope this information will be of value, and will be used by policy makers and elected officials within the State of Arizona and the other states of the Colorado River Basin, as well as federal government officials in both the United States and Mexico who are ultimately responsible for adopting and implementing an action plan to deal with these critical issues.

Planning Objectives

The YDP/Cienega Workgroup focused its work by defining a set of objectives with which its solutions must be consistent in order to be acceptable. These include fundamental objectives, which must be met by all solutions, and multi-functional objectives, which, if met, should result in a more broadly supported proposal.

• *Fundamental objectives*

- Solutions must reduce or eliminate the risks of shortage to Lower Basin water users associated with the continued bypass of Wellton-Mohawk IDD drainage water to Mexico without causing a permanent reallocation of entitlements to Colorado River water between and among the users of the Colorado River.
- Solutions must maintain the wildlife habitat and ecosystem values of the Cienega de Santa Clara.
- Solutions must maintain compliance with Minute 242 although the Minute may be subject to modification by mutual agreement of the United States and Mexico.

- ***Multi-functional objectives***

- To the extent possible, solutions should reduce impacts caused by high groundwater tables in the Yuma area by increasing drainage pumping.
- To the extent that desalinization is part of the solution, plans should attempt to provide for technology transfer that can be provided by operation of a large desalting plant.
- To the extent possible, solutions should seek to improve the quality of water provided for M&I purposes in the border region in Mexico and the United States.
- Solutions should be cost effective and attempt to demonstrate that all funds used to reach a solution are expended in a prudent and efficient manner. Where benefits beyond the national obligation to replace the bypass flow accrue to definite and identifiable beneficiaries, the costs of such additional benefits should be borne by those beneficiaries.
- To the extent possible, solutions should include measures that help offset or mitigate impacts of shortage and drought.

Considerations in Developing a Preferred Solution

In consideration of the wide array of available solution components, the Workgroup felt that it was important to recognize factors that make some alternatives preferable to others. Critical factors include: 1) complexity, 2) cost and ability to obtain funding, 3) timing, 4) water supply adequacy, and 5) Mexican involvement.

Recommended Solutions

As described in detail in this white paper, the YDP/Cienega Workgroup recommends that State and Federal policy-makers adopt a program to deal with the issues of the WMIDD bypass flow and the Cienega along the following lines:

- ***Adopt a short-term plan that can be implemented as soon as possible.***
 - To the extent possible and consistent with Arizona law, utilize Yuma area excess groundwater to meet Mexican Treaty delivery obligations.
 - Establish a shortage alleviation contingency fund to provide the financial resources to mitigate water supply disruption impacts to the extent the bypass flow is not otherwise offset or replaced.
 - Implement a pilot, Basin-wide, consumptive use reduction and forbearance program, based on voluntary, temporary land fallowing.
 - Continue funding, and take necessary actions to correct identified YDP deficiencies, assess the feasibility of using YDP as a potable water source for M&I use, and identify and make additional necessary adaptations to the Plant. Actions should allow YDP to be operational at a minimum of one third capacity, using Yuma area groundwater as an operational source.

- Implement a monitoring system and advanced research program in the Cienega.
- Identify and implement other programs that are not directly related to the bypass flows which will reduce the risk that a Lower Basin shortage will be declared as a result of the recent extraordinary drought.
- ***Adopt a long-term plan involving a combination of components that can be phased in over several years.***
 - Continue to implement advanced water conservation practices in the WMIDD in order to reduce its need for drainage pumpage.
 - Investigate and develop an adjustment to the Salinity Control Act that would modify the terms and conditions defining when there would be a national obligation to offset the bypass flow. The obligation could be deferred when mainstream reservoirs are high and hydrologic conditions are such that bypass flow replacement would not result in meaningful improvements to long-term system storage.
 - Continue, and permanently establish, the shortage alleviation contingency fund described in the short-term plan.
 - Continue the voluntary consumptive use and forbearance program based on the results of the pilot program.
 - Water inflow to the Cienega should be continued at the appropriate quantity and quality levels to maintain, or when feasible improve, its value as a wildlife and ecological reserve. Water supply should be provided from the WMIDD bypass flow or from other sources as appropriate. Adaptive management of the Cienega's environmental values should be based on the findings of the monitoring and research programs.
 - A program to reduce Colorado River water lost due to changed water orders or storm water inflows should be implemented. The United States should be given proportional credit for its investments in extraordinary water salvage as a substitute supply to offset the national obligation to replace the bypass flow.
 - The remaining component of the bypass flow replacement should be achieved through the development of additional excess groundwater in the Yuma area.
 - To the extent that the YDP is needed to desalinate Yuma area groundwater, the Plant's product water should be used for municipal and industrial (M&I) purposes in the United States and Mexico. Operation and maintenance of the YDP would need to be adjusted to conform to an M&I demand schedule.

Action Plan to Implement Recommendations

The YDP/Cienega Workgroup recognizes that implementing the short term and long term plans will take time and will involve many interests. The Workgroup recommends that the responsible agencies should move forward on multiple levels to carry out the following activities:

- The Bureau of Reclamation should expeditiously initiate a public process to address the issues related to the national obligation to replace the WMIDD bypass flows.
- The Bureau of Reclamation should continue correcting design deficiencies at the YDP to make it operational. Studies should be made to determine how best to use the YDP product water including the potential use for M&I purposes. New analysis should be undertaken on how best to dispose of the brine stream that results from Plant operation.
- The Basin States and the Bureau of Reclamation should initiate discussions regarding a program to re-regulate and salvage Colorado River water that is lost due to changed orders or storm water inflows. If necessary, legislation should be drafted to implement any resulting program.
- The Department of the Interior should undertake action pursuant to its Memorandum of Understanding with SEMARNAT or otherwise initiate consultations with appropriate federal agencies or transboundary institutions (such as the Department of State or the International Boundary and Water Commission) to ensure that a monitoring and research program is established in the Cienega, and that the United States initiates discussions with Mexican officials with regard to Mexico's participation in land fallowing, use of YDP product water for M&I purposes in Mexico, and opportunities to create additional flexibility in the administration of Minute 242.
- Arizona and California water agencies should determine potential border area communities' M&I demand for YDP product water.
- The Bureau of Reclamation should analyze the utility of several concepts to help alleviate bypass flow-related shortage impacts which include:
 - a Basin wide land fallowing program in the United States and Mexico,
 - establishment of a shortage alleviation contingency fund, and
 - use of excess Yuma area groundwater as a bypass flow replacement supply.
- The Bureau of Reclamation, in cooperation with the State of Arizona and Yuma area water users, should evaluate the opportunity to obtain additional water resources as a source of supply to Mexico or as a replacement supply to maintain the Cienega.

Balancing Water Needs on the Lower Colorado River: Recommendations of the Yuma Desalting Plant/Cienega de Santa Clara Workgroup

I. The Yuma Desalting Plant/Cienega de Santa Clara Workgroup

“Run the Yuma Desalting Plant! The Federal Government needs to fulfill its promise to the Basin States and salvage valuable Colorado River water resources,” one side argues.

“No! Don’t run the Desalting Plant. It’s too expensive and will cause irreparable damage to the Cienega de Santa Clara,” argues the other side.

“But the Cienega is artificial and is just an unintended consequence of the failure to run the Plant! And besides, it’s in Mexico. Let Mexico solve their own environmental problems,” the first side responds.

“Unintended or not, the Cienega is extremely valuable habitat and needs to be preserved! Impact to the Cienega will further threaten the survival of several listed endangered species,” the other side counters.

While the rhetoric over the issues related to the operation of the Yuma Desalting Plant (YDP) have made for interesting panel discussions at western water conferences, it has not been the kind of productive dialogue that will lead to a converging of viewpoints. Rather than continue down a path of increased confrontation - and no action - Sid Wilson, General Manager of the Central Arizona Project, thought a new approach should be tried. Sid decided to invite a group of knowledgeable individuals to form the YDP/Cienega Workgroup to see if a better solution could be reached. The members of the YDP/Cienega Workgroup were asked to share their expertise and ideas. The YDP/Cienega Workgroup would focus on developing a solution that would both offset the impact of the continued bypass of return flows from the Wellton-Mohawk Irrigation and Drainage District and preserve the viability of the Cienega de Santa Clara.

The members of the YDP/Cienega Workgroup were asked to participate in the process as individuals rather than as stakeholders. In other words, members did not have to represent the position of their employers nor in any way was it assumed that the groups or agencies they normally represent would even agree with or endorse the Workgroup’s recommendations.¹ The members of the Workgroup included (in alphabetical order): Thomas Carr, Jim Cherry, Michael Cohen, Peter Culp, Larry Dozier, Roger Gingrich, Pat Graham, Herb Guenther, Jennifer Pitt, Bill Rinne, and Sid Wilson. On several occasions, Francisco Oyarzbal assisted the Workgroup members by providing expert advice pertaining to conditions in Mexico.

¹ At the specific request of the State of Arizona, water users who hold contracts with the United States for the delivery of Colorado River water, and other stakeholders interested in the operation of the Yuma Desalting Plant, representatives of the Bureau of Reclamation have participated in meetings and discussions of this *ad-hoc* group. Notwithstanding this participation, the content of this report does not represent the official position of, or an endorsement of, the U.S. Department of the Interior, the U.S. Bureau of Reclamation, or the individual employees that participated in this process.

This white paper documents the findings and recommendations of the YDP/Cienega Workgroup. The Workgroup members desire to share their effort with a wider group of interested parties. They hope this information will be of value and be used by the policy makers and elected officials within the State of Arizona and the other states of the Colorado River Basin, and federal government officials in both the United States and Mexico who are ultimately responsible for adopting and implementing an action plan to deal with these critical issues.

II. Current Conditions

As with all issues related to the management of the Colorado River, any proposed action must be consistent with the “Law of the River.” The Law of the River is comprised of a series of international treaties, interstate compacts, court decrees, federal statutes, agency rules and regulations, and specific contract provisions. Most of these components have a degree of inter-relationship so it is often difficult to determine how actions related to individual issues can be implemented without considering how those actions may affect other, seemingly non-related conditions. This is true of the issues related to the bypassing of drainage flows from the WMIDD. However, there are three primary parts of the Colorado River laws that are especially relevant to this set of issues: 1) The Mexican Water Treaty of 1944 (Treaty); 2) Minute 242 dated August 30, 1973 which is titled the “Permanent and Definitive Solution to the International Problem of Salinity in the Colorado River” (Minute 242) and; 3) P.L. 93-320 - The Colorado River Basin Salinity Control Act of 1974 (Salinity Control Act). A brief synopsis of each is provided in the Appendix.

Controversy concerning the salinity levels in the WMIDD drainage flows began in the early 1960’s when the Mexican government objected that the quality of the Colorado River water being delivered pursuant to the Treaty was too saline to be used for irrigation. By the 1970’s the water quality issue had reached such a degree of concern that the Nixon administration appointed a special task force to identify solutions and then propose a recommendation for further negotiation with Mexico. The Task Force was chaired by Herbert Brownell Jr. The recommendations of the Task Force included the proposal to construct and operate the YDP as a means to salvage the return flows and to improve the quality of the water delivered to Mexico. Minute 242 and the Salinity Control Act were largely based on the compromises worked out by the Brownell Task Force.

It has been over thirty years since Minute 242 was signed and the Salinity Control Act became law. During that time many actions have occurred that have an effect on how the solution to the salinity problems and reclaiming of the bypass flows are viewed. While the features authorized in Title 1 of the Salinity Control Act have all been constructed, the Yuma Desalting Plant has never been operated as once envisioned. There have been a variety of reasons for the decision not to operate the YDP, but the primary reason is that the “Interim Period” provisions, as described in the Salinity Control Act, remained in effect. However, it is now generally agreed that the Interim Period has ended due to increased demand for water in the Lower Basin of the Colorado River and the onset of an “era of limits.”

The YDP Workgroup recognized that it is prudent to re-evaluate the opportunities available to meet Minute 242 obligations and the national obligation of replacing the bypass flow in light of changed conditions that have taken place over the past thirty years. Several of the key factors are listed below.

A. Colorado River management and reservoir conditions

After many years of abundant water supply and nearly full reservoirs, a serious multi-year drought has occurred in the Colorado River Basin. As a result of the drought, storage in the two primary reservoirs, Lake Mead and Lake Powell, is currently only about 50% of maximum capacity. Where just a few



years ago interim surplus guidelines were adopted to allow for additional water consumption in the Lower Basin until the year 2016, current discussions are focused on adopting guidelines for shortage declarations. The drought has raised the level of concern over opportunities to conserve and salvage water - including the potential to salvage the Wellton-Mohawk drainage water by activating the YDP.

Under current practice, the WMIDD drainage flow that is bypassed to the Cienega de Santa Clara is treated

as if the return flows were beneficially used. This means that, from an accounting sense, return flow credits are issued to the State of Arizona, and thus no Arizona water users are directly impacted by the bypass. However, to make up for the bypass water, additional releases from Lake Mead storage are required. This has the effect of gradually depleting the water reserves, which lowers Lake Mead levels. The lower level in Lake Mead first will impact potential beneficiaries of interim surplus guidelines water. If dry conditions continue long enough, Lake Mead depletions could reach the point that shortages must be declared in the Lower Basin. Under terms of the Colorado River Basin Project Act of 1968, most of the initial burden of a shortage declaration will be borne by water users of the Central Arizona Project. Furthermore, under terms of the Mexican Water Treaty of 1944, Mexico bears a proportional share of shortages under extraordinary drought conditions.

B. Wellton-Mohawk Irrigation and Drainage District

WMIDD is located in southwestern Arizona along the Gila River just east of the Colorado River. WMIDD diverts Colorado River water from Imperial Dam through the Gila Gravity Main Canal. Water is then turned out into the Wellton-Mohawk Canal. WMIDD was originally envisioned to serve 75,000 acres, but following reductions it now serves approximately 58,200 irrigable acres in the valley and 4,550 acres on the mesa. The District's contract for Colorado River water was originally for a consumptive use of 300,000 af/yr but has been reduced to 278,000 af/yr as a result of transfers that were associated with an Indian water rights settlement.

WMIDD operates a drainage system made up of 90 wells with a nominal spacing of 1 mile. The average depth of the wells is 100 feet. Drainage water is pumped into a concrete lined collector system. Collected water is conveyed westward to the Main Outlet Drain (MOD). The quality of the drainage discharge has averaged about 2,689 mg/l for the years 1999-2003. The volume of the drainage discharge for the same period averaged approximately 113,000 af/yr.

Legislation (P.L. 106-221) has been enacted to transfer the title to major project facilities from the United States to WMIDD. WMIDD has entered into a Memorandum of Agreement (MOA) with the Bureau of Reclamation (Bureau) to complete this transfer. The MOA contains a provision in which the WMIDD has agreed to accept the Bureau's goal of limiting delivery of agricultural return flows to the Yuma Desalting Plant's design capacity, and that WMIDD's water management activities will reflect this goal to the extent the goal remains relevant, regardless of whether the United States operates the YDP or not.

C. Cienega de Santa Clara

The Cienega de Santa Clara (Cienega) is the largest wetland remaining in the Colorado River delta in Mexico. The Cienega was historically a large overflow arm of the Rio Colorado, but was desiccated over time with extensive development of Colorado River water upstream. It is in a natural depression formed by the Cerro Prieto fault, a branch of the San Andreas fault line that enters the Gulf of California near the town of Santa Clara. The Cienega lies within a geologic basin



separated from the northern Gulf of California by a low, natural land barrier, which delineates the southwestern edge of the basin. In 1993, the Mexican government declared the Upper Gulf of California and the Colorado River delta as a Biosphere Reserve to protect threatened and endangered species. The Cienega is included within the Reserve's core boundaries.

The Cienega is sustained by three water sources. The present day Cienega began to form in 1977 following the discharge of water from the Main Outlet Drain Extension (MODE). The annual MODE flow has ranged from 97,285 af – 145,928 af/yr of drainage from WMIDD with a mean flow from 1994-2003 of approximately 109,100 af/yr at the border. The second source is the Riito Drain which carries approximately 12,800 af/yr of agricultural drain water from the San Luis irrigation district for disposal near the discharge point of the MODE canal. The third source is the natural seepage via artesian springs, of groundwater onto the mud flats.

The inflow water is not all consumed in the vegetation, but can be seen exiting the southern end, where it dries on the mud flats or mixes with ocean water that is occasionally driven into the southern end of the basin by wind and high tides.

Salinity of the inflow averages about 3,000 ppm for the MODE and about 4,000 ppm for the Riito Drain. Salinity concentration increases as the water disperses away from the MODE outfall. Water moves down the marsh in a plume following the Cerro Prieto fault line, a natural channel in the Cienega.

The continued release of MODE water to the Cienega has resulted in the expansion of the wetlands from several hundred acres in the 1970's to nearly 40,000 acres today, including a vegetated area of approximately 14,000 acres in the Biosphere Reserve, and an open water area of approximately 25,000 acres. The wetlands are a dynamic system, with the size and extent of the vegetated and open water areas varying with seasonal changes in inflows and evaporation; whether these areas will continue to grow under current inflow conditions is not known. Most of the vegetated portion of the Cienega is dominated by cattail. In the tidally influenced southwestern margin saltgrass is the dominant vegetation.

It appears that salinity in the lagoon likely limits the southern extent of emergent vegetation; studies of the Cienega have suggested that salinity is the major determinant of the size of the vegetated area as well as of the distribution of individual species within the vegetated area. Aside from areas influenced by natural artesian flows on the eastern boundary of the Cienega, salinity levels in the Cienega gradually increase southward, and are generally at their lowest in the northern portions of the lagoon nearest the inputs from the MODE and Riito Drain (where levels are driven by the salinity of the water in the two canals), increasing due to evaporation and evapotranspiration as the water flows southward along the plume. Vegetation begins to fail as salinity reaches critical levels; current science indicates the salinity tolerance of the cattails is reached in a range between 7,000 and 10,000 ppm, which delineates the southern extent of the vegetated area.

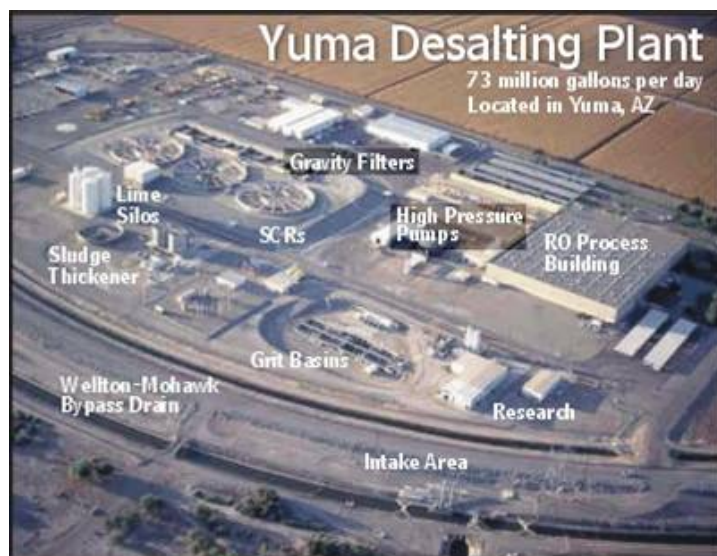
As a result it appears fair to assume that the size and extent of the vegetated area of the Cienega is closely related to the quality and quantity of inflows from the MODE and, to a lesser extent, the Riito Drain, with decreases in quality or quantity changing the salinity balance in the lagoon and resulting in corresponding reductions to the vegetated area over time. For example, in early 1993 water was cut off to the MODE due to flooding from the Gila River. By July there were gross reduction in vegetated acres of 58% for the lower Cienega and 76% for the upper Cienega compared to November data. Reintroduction of water the following year after repairs to the canal were completed resulted in rapid re-vegetation of both areas.

The brackish wetlands contain populations of two endangered species - Desert Pupfish and Yuma Clapper Rails - and support migratory and wintering waterfowl in the Pacific flyway. Historic fish surveys found populations of endangered desert pupfish in several locations within the Cienega. They were found near the terminus of the MODE, and other locations. The Cienega was found to support potentially the largest population of the Yuma Clapper Rail subspecies throughout its range. The latest survey of Rails in the Cienega was conducted in 1999 and 2000. However, using a conservative estimate, this wetland supports the largest population of the subspecies, with probably >70% of all Yuma Clapper Rails in Mexico and the United States.

D. Yuma Desalting Plant (YDP)

The YDP was constructed by the Bureau of Reclamation pursuant to authorization provided by Congress in Title I of the Salinity Control Act. Design for the YDP began in June 1977. Construction groundbreaking was in April 1980. The Plant was completed and began shakedown testing in December 1991. The YDP operated at one-third capacity for approximately six months in 1992 and 1993 before flooding on the Gila River damaged the canals which supply the Plant.

The Bureau conducted an extensive sizing study prior to the design and construction of the Plant. As a result of the study and the successful reduction in return flow from the WMIDD, the YDP as finally constructed has a capacity of 72.4 mgd. The YDP is a reverse osmosis (RO) desalination plant. While there are a variety of commercial



methods to desalinate and purify water in use around the globe reverse osmosis is one of the most effective, removing not only salt ions, but bacteria and viruses as well. In the United States RO is presently in widest use in Florida which has well over one hundred RO plants in operation serving customers ranging in size from high rise towers to communities as large as Jupiter and Cape Coral, Florida.

Traditionally RO plants are used to produce potable water. The YDP is not authorized or equipped for this use. Instead the YDP is authorized and equipped to recover (desalinate) a portion of the bypass flow from the WMIDD. This flow is transported to the YDP via the MODE, an open conveyance channel. Desalinated product water from the Plant is mixed with some untreated water from the MODE and the resulting blend is sent to the Colorado River for inclusion in water deliveries to Mexico. The concentrated salt stream or reject stream resulting from water desalination is mixed with other remaining flows in the MODE and conveyed to the Cienega.

The YDP was constructed as three units and therefore can be run at 1/3, 2/3, or full capacity. The process recovery factor is a function of membrane efficiency and is estimated to be between 73%-85%. Maintenance schedules will require units to be shut down periodically limiting output to from 75% - 80% of maximum under full operation conditions.

Since the YDP is a process plant, the quantity and salinity of the product water and reject stream can be made to vary over a broad range. Table 1 below illustrates some of the production range of the YDP, using average annual flows from 2004 as an illustration. This data also demonstrates the salinity of the flow that is sent to the Cienega is different than that of the YDP's reject stream. A common misperception is that these flows are synonymous.

Table 1

	YDP not operating	One third capacity operation	Two thirds capacity operation	Full capacity operation
Product water exiting the YDP				
Quantity (ac-ft)		23,438	42,392	64,598
Salinity (ppm)		122	148	160
Reject stream from the YDP				
Quantity (ac-ft)		8,669	15,679	23,892
Salinity (ppm)		7,818	7,747	7,715
Water sent to the Colorado River				
Quantity (ac-ft)		26,868	48,408	74,557
Salinity (ppm)		451	465	499
Flow to the Cienega at the international border				
Quantity (ac-ft)	109,100	82,232	60,692	35,543
Salinity (ppm)	2,820	3,347	4,093	6,206

At present the YDP is not operationally ready. In order to reactivate the Plant, design deficiencies require resolution, equipment startup activities must be commenced, and an environmental compliance process completed.

While progress has been made resolving plant design deficiencies, work remains to be completed on twelve deficiencies - six of those prior to beginning one-third capacity operations. Prior to commencing operation, all mechanical and electrical equipment, such as valves and pumps, will require testing and, as needed, repair. Wear parts, such as packing and belts, will have to be reinstalled on equipment. Instrumentation will require testing and calibration. While there are sufficient reverse osmosis membranes on site to support one-third capacity operations, additional membranes will be required to reach and sustain full capacity operations. Several major environmental compliance issues may be associated with potential YDP operations: 1) update of NEPA compliance for changed conditions since the original EIS was completed in 1975; 2) obtain a NPDES permit from ADEQ to allow discharge of water to the Colorado River; 3) ESA compliance; and 4) compliance with the Migratory Bird Treaty Act. The table below summarizes the time and funding requirements for operating the YDP.

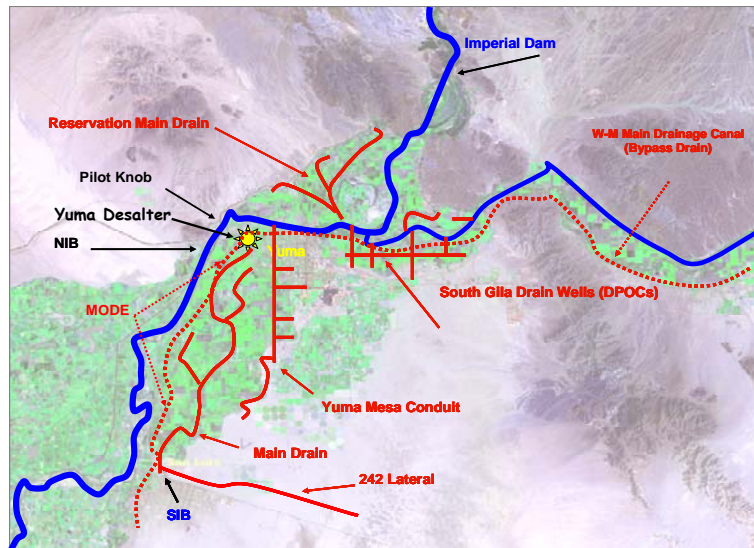
Table 2

	One third capacity operation	Two thirds capacity operation	Full capacity operation
Incremental one time cost (millions)	\$11.3	\$7.3	\$9.3
Minimum lead time required (months)	24	6	12
Cumulative annual cost (millions)	\$12.9 -16.5	\$19.8 -24.6	\$23.6 -28.8
<i>Ranges for annual cost are the result of variability in power cost, process recovery factor, on-stream factor and amortization period</i>			

E. Groundwater and drainage issues in the Yuma area

The Yuma area is one of the few areas in Arizona where there is an excess supply of water.

However, the excess supply is a problem in that it is difficult to remove, generally is higher in salt content than Colorado River water, and creates an additional cost for pumping on top of other farm operating costs. The long term application of Colorado River water to irrigated fields in the Yuma area has resulted in a buildup of ground



water that can have a negative effect on crop production. To avoid waterlogging, drainage facilities have been installed and are used extensively. Drainage facilities are in the form of both open channel drains and wells which pump water into drain channels. Drainage and waterlogging are chronic problems.

At the present time, the Yuma area irrigation districts believe that additional drainage pumpage is required to alleviate mounding problems. The irrigation districts, along with several government entities, formed an organization called the Yuma Area Water Resources Management Group (YAWRMAG) to see if water management issues can be addressed collectively. The Preliminary Report of the YAWRMAG effort recommended implementation of programs that would result in an increased amount of drainage pumpage in the Yuma agricultural areas to 90,000 acre feet per year.

In 2003 the Arizona legislature enacted Arizona Revised Statutes (ARS) §45-547 and §45-107.01 which contain provisions that would facilitate a cooperative program to aid the local water users in solving the waterlogging problem. The statutes create an opportunity for the United States to obtain a permit to pump the surplus groundwater in the Yuma Basin. If the United States uses the water in a manner which either offsets the Wellton Mohawk bypass flow or as a replacement supply for the YDP brine stream, Arizona would agree to waive return flow credits it otherwise would be entitled to claim.

III. Planning Objectives

A statement of objectives helps provide a focus for the formulation and evaluation of plans. Issues related to the Colorado River have many inter-related parts and it is often difficult to isolate issues. For example, it is hard to develop a plan to maintain and protect the Cienega without being cognizant of issues related to the ecosystem of the Colorado River delta as a whole. However, experience has shown that it is not usually possible to deal with too many issues simultaneously and that solving a more discreet set of issues will lead to incremental progress.

The YDP/Cienega Workgroup focused its work by defining a set of objectives with which its solutions must be consistent in order to be acceptable. These include fundamental objectives, which must be met by all solutions, and multi-functional objectives, which, if met, should result in a more broadly supported proposal.

A. Fundamental objectives

1. Solutions must reduce or eliminate the risks of shortage to Lower Basin water users associated with the continued bypass of WMIDD drainage water to Mexico.
2. Solutions must maintain the wildlife habitat and ecosystem values of the Cienega de Santa Clara.

3. Solutions must maintain compliance with Minute 242 although the Minute may be subject to modification by mutual agreement of the United States and Mexico without causing a permanent reallocation of entitlements to Colorado River water between and among the users of the Colorado River.

B. Multi-functional objectives

1. To the extent possible, solutions should reduce impacts caused by high groundwater tables in the Yuma area by increasing drainage pumping.
2. To the extent that desalinization is part of the solution, plans should attempt to provide for technology transfer that can be provided by operation of a large desalting plant.
3. To the extent possible, solutions should seek to improve the quality of water provided for M&I purposes in the border region in Mexico and the United States.
4. Solutions should be cost effective and attempt to demonstrate that all funds used to reach a solution are expended in a prudent and efficient manner. Where benefits beyond the national obligation to replace the bypass flow accrue to definite and identifiable beneficiaries the costs of such additional benefits should be borne by those beneficiaries.
5. To the extent possible, solutions should include measures that help offset or mitigate impacts of shortage and drought.

IV. Solution Components

The YDP/Cienega Workgroup reviewed a number of reports and supporting papers that identified and evaluated alternatives to the operation of the Yuma Desalting Plant. The Workgroup added additional ideas and concepts to that knowledge base which reflected more recent information and advances in technology. Many of the concepts rely on changes to the current legal framework, while others take advantage of opportunities to use otherwise unused or under-used water supplies. Conceptually, the Workgroup felt that there would not be a single solution component that could satisfy all of the fundamental objectives. The solution component identification effort was therefore geared to list a variety of ‘puzzle pieces’ that can be arranged in various combinations to result in a more optimal overall plan.

A. ***Water Supply*** – Water supply solutions provide a direct water supply to satisfy objectives.

1. Releases from storage ~ Water deliveries to Mexico can be made through releases from storage facilities in the U.S. as they have been since Minute 242 was adopted. This solution can be combined with other solutions which reduce the demand for water in the U.S. such as was done during the Interim Period through the lining of the Coachella Canal.

2. Wellton-Mohawk drainage water ~ This water source is the result of the need to drain and dewater lands under the WMIDD to prevent water logging and salinity buildup. This supply can be used as a water source to maintain a viable Cienega as it currently is and/or can be a supply source for the Yuma Desalting Plant which would be subject to treatment for delivery to water users.
 3. Groundwater from the Protective and Regulatory Pumping Unit (Minute 242 well-field) ~ This groundwater source would come from existing or additional wells on the U.S. side of the border that may be used to meet Treaty obligations or for other purposes. This supply source can be used as a replacement for drainage water that is currently delivered to the Southerly International Boundary (SIB) if that water is no longer available. The supply can also be directly pumped into the MODE for delivery to the Cienega if the Wellton Mohawk drainage water is no longer available.
 4. Groundwater from the South Gila Drainage Wells and other Yuma area wells ~ This water source is the result of the need to increase drainage pumping in the Yuma area to prevent water logging and soil salinity buildup. The additional groundwater may be discharged into the Colorado River for delivery to Mexico, or it may need to be treated or blended in order to improve its water quality. It also may be delivered to meet Treaty obligations at the SIB or as a replacement supply for the Cienega.
 5. Mexican drainage water ~ Improved drainage facilities and management in Mexico could be constructed resulting in an increased volume of brackish water supply. Drainage water from irrigated land in the San Luis Valley, Sonora could be captured and delivered to the Cienega de Santa Clara.
 6. City of Yuma and other communities' effluent ~ The City of Yuma owns and operates a wastewater treatment plant which produces high quality effluent. After committing the effluent for uses within its service area, there is likely to be additional effluent that could be purchased as a water supply source. The water could be discharged into the MODE to be used as an alternative or supplement to WMIDD drainage water to maintain the Cienega. Effluent from other communities in the vicinity, such as Somerton, Gadsden, and San Luis, could also become a potential water supply source.
- B. **Conservation measures** ~ Conservation measures provide an indirect water supply to satisfy objectives. Water which is conserved reduces overall demand thereby creating a “no net impact” situation. Water conservation, in the form of the Coachella Canal lining, was identified as the solution to the bypass flow during the Interim Period under the Salinity Control Act.
1. Offstream storage to re-capture water lost because of storm water inflow and changed water orders ~ Proposals are being investigated to provide additional regulatory storage in the lower portions of the Colorado River area in order to reduce over deliveries to Mexico that result from U.S. water releases that are not diverted as ordered. These proposals include rehabilitation of Senator

Wash Dam, and/or the construction of new regulatory reservoirs along the All-American Canal and the Wellton-Mohawk Canal. In recent years the amount of

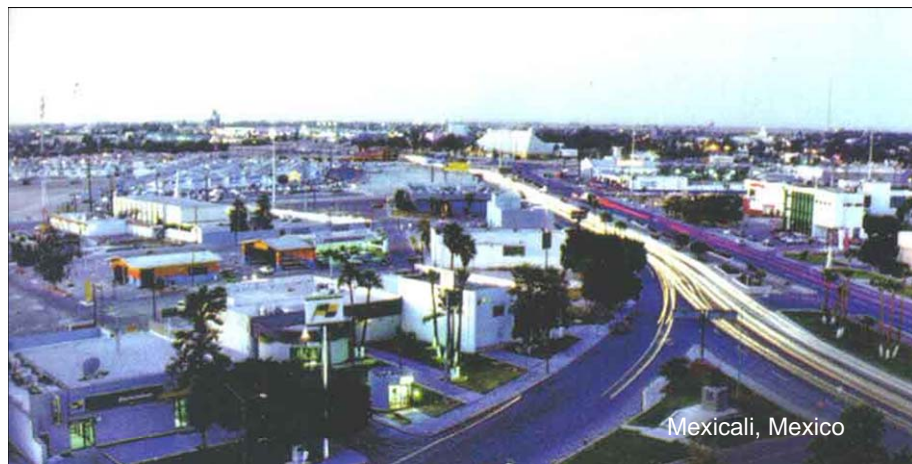


water loss has been as high as 337,000 acre feet (in 2000), due to localized rain storms that caused side inflows to the river and reduced water orders. Efforts are underway to significantly reduce that volume. The current forecast estimate for the year 2005 is about 106,000 acre feet. If the United States were to fund the construction of the physical works necessary to control and salvage these deliveries that are in excess of the Mexican water orders, it may be possible that this water could be used as an offset or credit against the continuation of the MODE bypass flow or YDP reject stream which have been identified as Federal obligations under the Salinity Control Act.

2. Land fallowing and forbearance options ~ Land fallowing involves payment to agricultural water users to reduce their use of Colorado River water on an annual basis. The resulting volume of water that is not consumed by crops (estimated to average between 4.5-5.0 acre feet per acre in the U.S. and 1.5-3.0 acre feet per acre in Mexico) is then credited to offset the obligation of the bypass flow. Land fallowing and forbearance can occur on an annual basis as needed or can be based on a long term option. Short term options may be more applicable for use in times of shortage as “dry year options.”
 - a. Land fallowing in the U.S. has different implications if the fallowing is pursuant to contract rights, present perfected rights, or Indian reserved rights.
 - b. Land fallowing in the U.S. may not be effective unless it is accompanied by a forbearance agreement by the relevant state or water junior water user who must agree not to order the unused water.
 - c. Land fallowing in Mexico may not be effective unless the Mexican government agrees not to place an order for the unused water. This may require an additional minute to the 1944 Treaty.
3. Water rights purchase and retirement ~ Water rights purchase and retirement is similar to the land fallowing options described above, but involves a permanent commitment to reduce water demand rather than a temporary commitment. Examples of permanent commitments to reduce demand include the water rights purchased from Yuma Mesa IDD for the Ak Chin

settlement and water rights purchased from Wellton-Mohawk IDD for the Salt River Pima Indian settlement.

- a. Water rights purchased from Wellton-Mohawk IDD may provide an extra benefit in that if less water is applied to the land, less drainage pumpage may be required. However, with less drainage pumpage, there would be less water flowing in the MODE to sustain the Cienega.
 - b. As with land fallowing options, forbearance agreements by the state, junior water users or the Mexican government may be required to prevent the conserved water from being ordered by other water users.
4. Mexican water conservation and drainage control ~ This option was contemplated in Paragraph 7 of Minute 242 as a means to improve Mexican irrigation efficiency and to provide better drainage to keep soils from developing salinity buildup. Reduced demand for water in Mexico would allow the Mexican water users to order less water and thereby absorb some or all of the impact of the bypass flows.
- C. ***Municipal and industrial water supply measures*** ~ M&I measures would deliver drinking water quality supplies to U.S. or Mexican water users who otherwise would be utilizing Colorado River water.
1. Mexican water deliveries ~ It has been reported that the growing communities of San Luis and Mexicali in Mexico are in need of higher quality water supplies than they currently use. Desalted drainage water could be treated to drinking water standards and delivered to Mexico via new pipelines. To the extent that the water is delivered in lieu of current Treaty-based deliveries, less water would need to be released from upstream storage reservoirs.



2. Yuma County area ~ This proposal would provide potable water to Yuma area communities such as Yuma, San Luis, or Somerton. Yuma has indicated that even though the Salinity Control Act provides them the right of first refusal, they are not currently interested in purchasing potable water from the YDP.

3. Other water users ~ The possibility exists that other water users such as the Southern Nevada Water Authority could take advantage of unused capacity in the YDP to treat drainage water. The additional water would be delivered to Arizona or Mexican water users, thereby freeing up water that could be used either through water banking exchanges or as unused Arizona apportionment.
- D. ***Changes to legal requirements, adaptive management programs, and impact mitigation measures*** ~ Within the context of an overall plan, certain requirements of the Salinity Control Act or other relevant laws could be revised to reflect current information and changed conditions. An adaptive management program for the Cienega de Santa Clara would allow new information gained through enhanced monitoring and research to be used effectively to enhance environmental values. Impact mitigation measures are mechanisms to reduce or eliminate the direct impacts on water users. The water users have long been concerned that the failure to reclaim or otherwise offset the bypass flow will lower system reservoir levels to the point where a Lower Basin shortage would have to be declared. Impact mitigation measures would be structured to provide an alternate water supply to replace the supply lost due to the shortage condition, but only to the extent the shortage was caused or increased due to the failure to offset the bypass flows.
1. Degree to which the United States must provide an offset to the Wellton Mohawk bypass flows ~ The Salinity Control Act states that the Federal obligation to replace the bypass flow is waived whenever there is a surplus as defined by the Mexican Treaty. Even if there is no formally declared surplus, when reservoir levels are high, the requirement to replace the bypass water could be waived because there is a high probability that the water will be spilled. Since many solution components are expensive, there could be a considerable reduction in expenditures if the Federal obligation to salvage the bypass flow is deferred until the Lake Mead storage level is declining.
 2. Quantity and quality of water needed to maintain the Cienega de Santa Clara ~ Under current conditions all of the Wellton Mohawk drainage water is bypassed. This volume is approximately 110,000 acre feet although in some years it is significantly higher. The ability to determine the optimum water quality and quantity for the Cienega can only be answered by implementing a cooperative monitoring and data gathering plan. The monitoring plan needs to be developed so that a determination can be made about the relationship between water volumes, salinity levels of the water, and the amount of habitat the water supply will support. The monitoring program will eventually evolve into an adaptive management program where the knowledge gained from the research will be used to better achieve wildlife habitat and other environmental goals.
 3. Shortage alleviation contingency fund ~ Federal funds that would otherwise have been expended to operate the YDP, purchase forbearance agreements or otherwise mitigate for the MODE bypass flow would be set aside each year in a 'shortage contingency fund.' Funds would be deposited annually and would

accrue up to some predetermined cap. The amount of annual deposits committed to the shortage contingency fund could range from the estimated cost associated with fallowing and forbearance agreements to the estimated cost of operating the YDP at full capacity plus the additional cost associated with replacing the volume of the reject stream. These funds would be utilized to fund temporary forbearance agreements, economic mitigation, or other temporary use reduction measures to reduce shortage risks to water users when shortages are declared or to fund anticipatory mitigation measures in low reservoir conditions. This would allow accumulation of the financial resources necessary to mitigate the impacts of bypass flows to reservoir storage during periods of relative water abundance (when physical replacement of the bypass flows is least likely to benefit water users and could result in storage of water that would subsequently be spilled). These resources could then be expended to make significant contributions to the preservation of reservoir storage and mitigate drought impacts during periods of water scarcity (when the risk of shortage caused by the cumulative impacts of failure to replace bypass flows is most likely to impact water users).

4. Water banking and recovery ~ This option would be modeled after the Arizona Water Banking Authority program which stores water underground until it is needed in a time of shortage on the Colorado River. Under this option, the U.S. would offset the impact of the bypass flow in times of shortage by providing junior priority water users water from the banked supply that the U.S. had purchased in prior years.
 5. Changes to Minute 242 ~ Under this option, the impact of delivering water supplies from sources that have higher salinity levels (such as Yuma area drainage water) would be accepted by the Mexican government. This would allow additional water sources to be used to meet the Mexican Treaty obligation which do not involve releases from upstream storage. This option would need to be used in conjunction with other options which provide an offsetting benefit to Mexico.
- E. **Infrastructure** ~ In addition to legal, monetary, and institutional measures, there will need to be some utilization of “bricks and mortar” components to allow the implementation of some of the water supply measures.
1. Yuma Desalting Plant ~ The YDP can be operated to improve the quality of brackish water by removing salts. The plant can be operated at 1/3, 2/3, or full capacity based on its modular design. It may also be possible to increase the output of the plant beyond the current maximum design through improvements in technology. Water sources for the YDP could be from the Wellton-Mohawk drainage supply, the Yuma area drainage supply, or some combination of the two. Generally, it will be less expensive and more efficient if the source supply is the Yuma area drainage water since much of the water is of lower salinity than the Wellton-Mohawk supply. Yuma area groundwater requires less pretreatment prior to desalination and is also lower in salinity.

2. Brine stream disposal alternatives ~ The current plan for the disposal of the YDP brine stream is to discharge it through the MODE to the Cienega. The high concentration of salts in the brine stream could do damage to the ecosystem of the Cienega. In order to avoid this impact, a new brine pipeline may be needed which terminates somewhere other than the Cienega or at least at the southern end of the Cienega near the Gulf of California. Other options include blending the brine stream with better quality water or disposal to a new location where it may provide an environmental benefit.
3. Yuma area drainage collection pipelines ~ Proposals that envision increased drainage pumping may require additional plumbing features. New wells may need to be drilled and new collection canals and pipelines may be needed. If the salinity of the drainage water is such that it cannot be discharged into the Colorado River above Morelos Dam, it may need to be transported to the YDP for treatment prior to use to meet Treaty obligations or as a municipal water supply.
4. Mexican drainage collection infrastructure ~ Proposals that envision increased drainage pumping or construction of tile drains in Mexico may require expanded or new infrastructure. If the intention is to capture the drainage water and use it for environmental purposes, then the drain water must be delivered to the Cienega or some other desirable end use point.
5. Potable water delivery pipelines ~ Proposals that envision use of treated water from the YDP to be used for direct delivery for M&I purposes will require new delivery infrastructure. The pipelines could be constructed on a bi-national basis with the U.S. bearing the costs associated with U.S. deliveries and Mexico bearing the cost associated with Mexican deliveries.

V. Considerations in Developing a Preferred Solution

In consideration of the wide array of available solution components, the Workgroup believes that it is important to recognize factors that make some alternatives preferable to others. No attempt has been made to formally rank alternatives, but the Workgroup informally used these factors to develop its recommendations. These factors include the following:

- A. **Complexity** ~ Complex solutions that will require multiple layers of approvals, funding, or implementation are less likely to be implemented. While complex problems often result in complex solutions, the Workgroup favored simpler plans that would be more likely to be implemented.
- B. **Cost and the ability to obtain funding** ~ It is likely that all plans will be expensive. Less costly plans are more likely to be funded and therefore implemented. If feasible, cost sharing by identified beneficiaries would also improve the chances of obtaining funding.
- C. **Timing** ~ The Workgroup believes that timing is critical and that a dual track approach regarding the timing of implementation is necessary. A short-term solution is one that can be initiated quickly and may provide partial or full relief

for an interim period. A long-term solution is one that may take more time to implement, but once implemented will be sustainable for a much longer period. All facilities have a useful project life, but that life can be extended with proper consideration of maintenance and replacement.

- D. ***Water supply adequacy*** ~ In looking for long term solutions, the sustainability of any given water supply alternative must be considered. For example:
1. Life of the WMIDD drainage flow ~ Even without the operation of the Yuma Desalting Plant, there is no assurance that bypass flows will continue indefinitely at their current quantity and quality. Various factors, including changing land uses, may reduce future flows in the MODE.
 2. Yuma area groundwater mound surplus ~ If drainage pumpage in the Yuma area is increased with the goal of lowering general water tables, it is possible that at some point in time, drainage pumpage can be reduced to reflect a new equilibrium situation.
 3. M&I supply source ~ A municipal water supply must have a highly reliable water source. If the YDP is used to treat water for municipal purposes, the supply must be adequately reliable in spite of potential technical and maintenance issues relating to the desalting process.
- E. ***Mexican involvement in the determination of preferred alternatives*** ~ Since the Cienega is located in Mexico, Mexican officials must be a part of the discussion of any solution which is intended to preserve the Cienega. Mexico could also be a beneficial participant in many of the solution programs, such as land fallowing and forbearance and development of an M&I supply.

VI. Recommended Solutions

It is apparent that there are numerous ways to combine solution components to address the fundamental and multi-functional objectives. It is also apparent that there is no one perfect solution and that to be successful, parties who hold opposing positions will need to reach a compromise. With that perspective in mind, the Workgroup is recommending that State and Federal policymakers adopt a program to deal with the issues of the WMIDD bypass flow and the Cienega along the following lines:

- A. ***A short-term plan should be adopted and implemented as soon as possible.*** The goal of the plan would be to initiate action while more permanent long-term plans are formulated and implemented.
1. To the extent that additional drainage water can be directly discharged to the Colorado River without impacting the Minute 242 salinity differential, the Bureau, in cooperation with local water districts, should increase the Yuma area return flows and use that supply to offset the bypass flow in a manner consistent with Arizona state law.
 2. The Bureau should establish a shortage alleviation contingency fund to prepare for and mitigate water supply disruption impacts to the extent that the bypass flow water supply is not offset or replaced. These resources could be

expended to make much more significant contributions to the preservation of reservoir storage and mitigate drought impacts during periods of water scarcity (when the risk of shortage caused by the cumulative impacts of failure to replace bypass flows is most likely to impact water users).

3. Implement a pilot Basin-wide voluntary consumptive use reduction and forbearance program to reduce the potential for shortages. The program should be solely based on voluntary temporary land fallowing, but only to the extent that there will be no permanent reallocation of entitlements to Colorado River water between and among the users of Colorado River water.. Opportunities to participate in the program should be offered to water users in both the United States and Mexico. The target volume of the forbearance program could be tied to funding level, Lake Mead storage content, or by some other appropriate negotiated limit. The pilot program should be operated for a defined period of time after which an evaluation of the program's effectiveness and cost should be prepared to determine (1) if this approach should be included in a long term plan and/or (2) evaluate its potential effectiveness in conjunction with the shortage alleviation contingency fund.
4. Continue funding and take necessary actions to correct identified YDP deficiencies, assess the feasibility of using YDP as a potable water source for M&I use, and identify and make additional necessary adaptations to the plant. Actions should allow YDP to be operational to a minimum of one third capacity using Yuma area groundwater as an operational source.
5. Immediately implement a monitoring system and advanced research program in the Cienega de Santa Clara to identify the relationships between quality, quantity and environmental conditions and to monitor environmental changes and trends.
6. Continue to investigate and, when appropriate, implement programs not directly related to the bypass flow which have the effect of reducing risk of Colorado River shortages, such as management of tributary inflows for delivery or Colorado River water supply augmentation.

B. *A long-term plan involving a combination of the components described below should be developed and phased in over several years.* The long term plan would be designed to be effective for an extended period of up to 25 or more years. The plan should be flexible and should be adjusted as needed to meet the planning objectives.

1. To limit the volume of bypass flow, and thus the overall magnitude of the federal obligation, WMIDD should continue to implement advanced water conservation practices in order to reduce its need for drainage pumpage.
2. The Bureau, in conjunction with interested parties, should seek an adjustment to the Salinity Control Act that would modify the terms and conditions defining the national obligation to offset the WMIDD bypass flow. The intent of the amended terms will be to provide flexibility to forgo or delay the

replacement of bypass flows when: 1) reservoir levels are high (even if below levels resulting in the declaration of a Treaty surplus or a flood control release), and 2) hydrologic conditions are such that replacement would not result in meaningful improvements to long-term system storage. The relaxed terms for defining the national obligation could result in considerable cost savings to the federal government. In exchange for the increased flexibility in satisfying the national obligation and associated cost savings, the increased risk to water users from reservoir drawdown when drought cycles resume would be offset by the implementation of the shortage alleviation contingency fund and mitigation program.

3. Continue and permanently establish the shortage alleviation contingency fund described in the short term plan.
4. Continue the voluntary consumptive use reduction and forbearance program based on the results of the pilot program. The program would be funded through permanent establishment of the shortage alleviation contingency fund. Program components could include:
 - a. Creation of a permanent international dry year option land fallowing program to be utilized during shortage years. Water right leasing should be dispersed to avoid concentration of impacts. As with the pilot program, land fallowing must be accomplished in a manner where there will be no permanent reallocation of entitlements to Colorado River water between and among the users of Colorado River water.
 - b. Participation by the federal government in water banking activities as a means to mitigate shortage impacts.
5. Water inflow to the Cienega de Santa Clara should be continued at the appropriate quantity and quality levels to maintain, or when feasible, improve its value as a wildlife and ecological reserve.
 - a. The primary source of water supply for the Cienega will likely continue to be the WMIDD drainage flow. However, if those flows are reduced or otherwise altered, water should be provided from groundwater withdrawn from Minute 242 wells, Yuma Valley drainage wells, effluent, storm runoff or other sources to substitute for or manage the quality and quantity of those flows.
 - b. The monitoring and research program at the Cienega should evolve into an adaptive management program with the goal of maintaining or improving current habitat conditions.
 - c. To the extent the YDP is operated, any associated brine stream must be discharged in a manner that is not detrimental to the Cienega. This could include routing the brine stream around the primary vegetated zone with a new pipeline. Options for utilizing the brine stream in an environmentally beneficial manner should also be explored.

6. A program to reduce water lost due to storm water inflows and changed water orders should be implemented to the greatest extent feasible to capture otherwise unaccounted for water. While efforts should be made to minimize losses through improved water ordering practices, it is recognized that a certain amount of loss is inevitable. Recapture of this supply by construction of new re-regulatory storage reservoirs and rehabilitation of Senator Wash Dam would represent an extraordinary effort to salvage a water supply that otherwise would be lost. The United States should be given proportional credit for their investments in extraordinary water salvage as a substitute supply to offset the national obligation. The potential exists for these credits to represent a significant contribution toward satisfying the national obligation without requiring the direct replacement of the bypass flow.
7. The remaining component of the bypass flow replacement should be achieved through development of additional excess groundwater in the Yuma area. Based upon the study information derived under the short term program, a long term coordinated groundwater management program should be developed in consultation with the Yuma Area Water Resources Management Group and the State of Arizona. The management plan will determine how much and from which locations excess groundwater should be withdrawn. The increased use of this supply to create return flows can be credited against the national obligation to replace the bypass flows.
8. Due to the elevated salinity level of the Yuma area groundwater, it will probably be necessary to desalinate some of the water before it can be beneficially used. To the extent feasible, any water treated by YDP should be used as an M&I potable water supply. In order to achieve cost recovery from potential beneficiaries, cost sharing - at least for a portion of treatment costs - should be a condition of receiving water.
 - a. In lieu of cost sharing, the United States should attempt to negotiate an exchange ratio with water users in Mexico. Under this concept, Mexico would receive treated water at a cost savings, but for every acre foot of treated water delivered, they would be debited at a rate of two or more acre feet in the accounting of water delivered under the Treaty. The United States would take a credit for the exchange ratio savings against the national obligation to replace the bypass flow.
 - b. Because M&I water must be available reliably on a year-round basis, the YDP must be capable of producing product water throughout regular maintenance periods. This means that at least one third capability must be kept in reserve status.

VII. Action Plan to Implement Recommendations

The YDP/Cienega Workgroup recognizes that implementing the short term and long term plans will take time and will involve many interests. The Workgroup recommends that the responsible agencies should move forward on multiple levels to carry out the following activities:

- A. The Bureau of Reclamation should expeditiously initiate a public process to address the issues related to the national obligation to replace the Wellton-Mohawk bypass flows. This process should include the technical, economic, and environmental evaluation of alternatives including the YDP Workgroup's recommendations with regard to the Cienega. The public process can proceed on multiple tracks to ensure that all relevant information is available in a timely manner. To the extent required, NEPA analysis for bypass flow replacement alternatives should be initiated.
- B. Regarding the use of the Yuma Desalting Plant, the Bureau of Reclamation should:
 - 1. Continue to identify and implement YDP design deficiency corrections.
 - 2. Determine if YDP product water can meet standards necessary for M&I use and identify opportunities and demand for M&I use of treated water and necessary plant alterations.
 - 3. Evaluate options and cost for a new brine stream bypass pipeline and other options for brine stream disposal, including blending with water of lower salinity.
- C. The Basin States and the Bureau of Reclamation should initiate discussions regarding a program to re-regulate and salvage water that is lost due to changed orders or storm water inflows. If necessary, legislation should be drafted to implement any resulting program.
- D. The Department of Interior should undertake action pursuant to its MOU with SEMARNAT or otherwise initiate consultations with appropriate federal agencies or transboundary institutions (such as the Department of State or the International Boundary and Waters Commission) to ensure that a monitoring and research program is established in the Cienega, and that the United States initiates discussions with Mexican officials with regard to:
 - 1. Mexico's willingness to participate in a land fallowing and forbearance program, including scope and cost.
 - 2. Mexico's interest in obtaining treated M&I quality water for Mexican communities.
 - 3. Mexico's willingness to consider additional flexibility in calculating the salinity differential under Minute 242 in those years when the salinity measurement of the Colorado River reflects a better quality.
 - 4. Mexico's participation in cooperative studies and monitoring programs in the Cienega.
- E. The states of Arizona and California should initiate inquiries within their states regarding demand for potable quality product water from the YDP for communities in the border area.

- F. The Bureau of Reclamation should initiate a land fallowing pilot program on a Basin-wide basis.
- G. The Bureau of Reclamation should study the viability and funding requirements for establishing a shortage alleviation contingency fund. The study should identify how the fund would be established, who would manage it, how would the money be spent, whether it should be operated as a revolving fund or a grant fund, and what type of mitigation programs could be set up to utilize the fund.
- H. The Bureau of Reclamation should complete advanced hydrologic studies to evaluate sustainability and quality of Yuma area groundwater mound. They should then proceed to obtain a permit to pump Yuma drainage water pursuant to ARS §45- 547. The Arizona Department of Water Resources should expedite processing of the permit application.
- I. The Bureau, in cooperation with the State of Arizona, should evaluate the ability to obtain and use Yuma Valley drainage, Yuma County communities' effluent, storm water, Minute 242 well field pumpage and other sources as a source for delivery to Mexico or as a replacement supply to maintain the Cienega.

Appendix

Law of the Colorado River

- Mexican Water Treaty of 1944 – The Mexican Water Treaty deals with the allocation and management of three international rivers: the Colorado River, the Rio Grande, and the Tijuana River. Under terms of the Part III of the Treaty, Mexico is normally entitled to a guaranteed annual quantity of 1,500,000 acre feet of water delivered at two points along the Mexican-US border. However, under extraordinary drought conditions, Mexico would share any shortages with the water users in the United States, and when there is water in excess of United States needs, Mexico would receive a surplus delivery of up to 200,000 acre-feet. One of the terms of the Treaty is that the Mexican water delivery can be derived from any water, regardless of its origin. The intention of this provision was to recognize that return flows from agricultural uses within the United States would be a significant component of the water supply delivered to Mexico. The Treaty deals only with the quantity of water deliveries and makes no provisions related to the quality of the water supply.
- Minute 242 – Minute 242 is dated August 30, 1973 and is titled “Permanent and Definitive Solution to the International Problem of Salinity in the Colorado River.” The Minute, which is a diplomatic agreement between the United States and Mexico, was intended to resolve issues raised by Mexico related to the high levels of salinity in the water being delivered under the Treaty. The salinity issue came to a head after the Wellton-Mohawk Irrigation District began discharging drainage return flows into the Colorado River above the Mexican diversion points. The return flows were especially high in salinity and Mexico protested that the water was unusable for irrigation purposes. The Minute was the result of a multi-year process of study and negotiations. As a result of the Minute, the United States agreed to deliver water at the northern Mexican delivery point that would be within an average annual salinity level of 115 ppm. ± 30 ppm compared to the average annual salinity level of the water at Imperial Dam. This provision has come to be referred to as meeting a salinity “differential.” The United States also agreed to bypass the return flows of the Wellton-Mohawk District and deliver them to the Cienega de Santa Clara near the Gulf of California. The Minute envisioned that a desalting plant would be constructed to treat the Wellton-Mohawk drainage water to a point where it could again be discharged to the Colorado River without violating the salinity differential. Once the plant became operational, the brine stream, which is a highly concentrated byproduct of the desalinization process, would be bypassed to the Cienega.
- Colorado River Basin Salinity Control Act of 1974– Title 1 of the Salinity Control Act deals with features downstream of Imperial Dam and is the federal law that authorized the measures necessary to implement Minute 242.

The Act authorized the construction and operation of the Yuma Desalting Plant which was intended to reclaim a portion of the Wellton-Mohawk drainage water. All costs associated with the Plant were non-reimbursable to the federal government.

The replacement of any water bypassed to the Cienega including any bypass of the brine stream after the Desalting Plant became operational was mandated and is considered a “national obligation.” The Act does not require the replacement of the Wellton Mohawk bypass or the brine stream in any year when the Colorado River is found to be in “surplus” as defined by the Mexican Treaty.

Funds were provided to implement advanced water conservation techniques within the Wellton-Mohawk District with the goal of significantly reducing the volume of the drainage flow.

The Act authorized the Secretary of the Interior to construct and operate a well field near the Mexican border capable of withdrawing 160,000 acre feet per year as allowed pursuant to one of the terms of Minute 242.

To offset the effects of the bypass flow during what is described as an “Interim Period,” the Act authorized the lining of a portion of the Coachella Canal in California. The savings in seepage losses were credited to the federal government as an offset to the continued bypass of the drainage flow prior to the operation of the Yuma Desalting Plant.